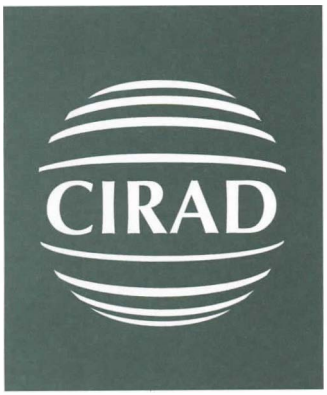


Département territoires, environnement et acteurs
Cirad-tera

RUBBER PLANTING MATERIEL AVAILABILITY AND PRODUCTION IN JAMBI PROVINCE

EXECUTIVE SUMMARY

Jakarta, June 1998
A cooperation between the World Bank and the Governement of Indonesia

Eric PENOT - CIRAD/TERA
Gede WIBAWA - IRRI
Iwan KOMARDIWAN - ICRAF

Programme Tropiques Humides
N° 13/TH/98

RUBBER PLANTING MATERIEL AVAILABILITY AND PRODUCTION IN JAMBI PROVINCE

EXECUTIVE SUMMARY

Jakarta, June 1998
A cooperation between the World Bank and the Governement of Indonesia

Eric PENOT - CIRAD/TERA
Gede WIBAWA - IRRI
Iwan KOMARDIWAN - ICRAF

Programme Tropiques Humides
N° 13/TH/98

Jambi Regional Development Project

RUBBER PLANTING MATERIAL AVAILABILITY AND PRODUCTION IN JAMBI

Erpo Penot
Gede Wibawa
Iwan Komarudiwan

The World Bank and the Government of Indonesia

EXECUTIVE SUMMARY

RUBBER PLANTING MATERIAL AVAILABILITY AND PRODUCTION IN THE JAMBI PROVINCE

In Indonesia, jungle rubber is the traditional rubber cropping system with very few inputs and almost no labour used during the immature period. Jungle rubber has enabled hundred of farmers to settle permanently in Sumatra and Kalimantan and to gain a reasonable income for years since the turn of the century.

However alternative crops (e.g. oil palm) and cropping systems (monoculture) with a far better productivity now challenge the jungle rubber system. It is becoming necessary for many farmers to improve their rubber productivity. As in many other cropping systems, improved planting material is the very first step that allows a significant increase in productivity, generally from 500 kg/ha/yr with seedlings in jungle rubber to 1400-2000 kg/ha/year for clonal rubber.

The necessity of adopting rubber clones raises 3 main problems :

- the availability of such planting material
- the quality (clonal purity) of clones
- the technical information required to adopt clones in various systems : monoculture or agroforestry systems (RAS).

The present study will deal mainly with the first two topics.

1 Objectives of the study

The objective of this study is to assess the quality and availability of clonal rubber in the province of Jambi (Sumatra).

After defining precisely which types of planting material are available for rubber in general, in the first chapter we will present the team's clonal recommendations, and the necessity of using the electrophoresis technique to guarantee the quality of clones at the preliminary multiplication stage.

The detailed objectives of the study are the following :

- inventory and evaluation of the existing government sources of planting material (budwood gardens and nurseries) in and around the Project area, including Dinas Perkebunan, BPP Sembawa and TCSDP nurseries.
- inventory and evaluation of village budwood gardens and nurseries built within government projects
- inventory and evaluation of private nurseries.

These points will be developed in Chapter 2.

- evaluation of production and distribution costs (Chapter 3)
- needs and purchasing power of smallholders regarding rubber planting material (Chapter 4)

- Proposals (Chapter 5)

The study area comprises 3 Kabupaten of the Jambi province : Kabupaten Batang Hari, Kabupaten Sarolangun/Bangko or "Sarko" and Kabupaten Bungo Tebo.

The methodology used for this study is based on a survey of private nurseries (sample of 30, roughly 30 % of the total nurseries), a survey of BANDES budwood gardens (sample of 30, 10 % of the total), and a survey of all existing government budwood gardens and planting material supply projects.

Surveys of private nurseries and BANDES programme were implemented between January and March 1998. The other surveys were conducted during an appraisal mission in March 1998.

1 The improved rubber planting material : the clones.

The only improved planting material that is considered valuable and cost effective in this report will be the clones (grafted stumps).
Clonal rubber production needs at least some infrastructure: budwood gardens as a source of budwood, and rootstock nurseries. The final product is a clonal grafted stump, that can be sold as a stump or planted in a polybag.

The recommended clones should be the following: first priority: RRIC 100, BPM 1, BPM 24, PB 260, RRIM 600; and second priority : GT1.

It is necessary to rely on a fully certified and purified source for budwood. The only current reliable means of verifying and certifying clone purity is use of the electrophoresis technique (CIRAD-BIOTROP). The best institution to implement such clonal purity analysis and control activities seems to be the Research Centre of Sembawa (South Sumatra), which should be provided with a collection budwood garden, facilities, and the technicians, to implement such activity. Sembawa, as a research station, also has the mandate and the reputation to guarantee the clonal purity of stumps provided to projects.

The use of the electrophoresis technique aims to establish solid foundations for a high quality rubber clonal planting material supply system by ensuring clonal purity to the key budwood gardens from which all further plantations will be established. The use of the electrophoresis technique will also enable reliable and unquestionable control of quality and clonal purity in planting material production by projects or private nurseries.

2 A review of the existing sources of IMPROVED PLANTING MATERIAL

Several types of projects have been or are still being implemented in the area, using various sources of planting material as displayed in Table 1. We can distinguish 3 types of projects :

- the full-package approach : the PMU approach with SRDP, TCSDP (Table 2).
- the partial approach : providing to farmers only a limited number of inputs and information for the first year (table 3).
- specific projects for planting material supply : village budwood gardens (BANDES), supply of stumps (DISBUN) , supply of budwood (PSSP)...(Table 4)

We will focus our study on projects that supply planting material to smallholders.

The situation may be summarized as follows :

- There is NO homogenous policy for planting material supply : budwood is free at P2KP2/DISBUN budwood gardens and sold at subsidized prices at PSSP/DISBUN budwood gardens. Stumps are sold at 125 Rp by P2RT, and between 250 and 350 Rp by private nurseries. This situation is very confusing for farmers but at least, sources of planting material do exist.

- The process of budwood purchase is rather long and not straightforward, involving visits to the DISBUN office to order and pay, before actually taking the budwood.

- The sale of subsidized stumps is organised through the Camat and some extensionists (PPL). There is obviously a problem of information and distribution

- The current potential budwood production for the 2 clones among our selection (BPM 1 and BPM 24) is rather small, allowing a maximum of 2 000 hectares to be planted each year by farmers with access to this planting material. Some budwood gardens need a serious programme of clonal purification

- The current budwood garden network does not provide the recommended clones, except for BPM 1 and BPM 24. It therefore necessary to plant new budwood gardens with the selected clones, (in particular PB 260, RRIC 100 and RRIM 600), in addition to the rehabilitation of existing budwood gardens..

Inventory and evaluation of village budwood gardens and nurseries built within government projects.

BANDES/INPRES Desa programme (village budwood garden programme)
Budwood from BANDES is totally unusable (the clones have been mixed up). Farmer groups or private nurseries still using these, or using small private budwood gardens derived from BANDES should be provided with new budwood gardens. The quality of planting material is very bad.
The failure of the BANDES programme is due to a lack of preparation and information during establishment, and also a lack of follow up in the long term.
Development of village budwood gardens still has potential in certain circumstances, such as remote or poor areas, if implemented with a participatory approach.

TCSDP
TCSDP village budwood gardens have been relatively well implemented until now, however it is possible they could deteriorate along the same lines as BANDES if access for farmers is not secured in the long term.
It is NOT recommended that budwood gardens be established with planting material from private nurseries which have not been certified. Clonal plants used in budwood gardens should be provided by Level 1/budwood gardens.
The quality of the plants depends on the quality of those provided by private nurseries.
The TCSDP budwood garden experience shows that establishment of good quality village budwood gardens is possible with well trained staff

Inventory and evaluation of private nurseries.
Private nurseries are obviously the best way to meet demand, on the condition that stump production is controlled with respect to quality (certified budwood), and also quantity (by auditing of the no. of stumps produced in relation to the actual production or supply of certified clonal budwood) to reduce the possibility of production of "fake" (non clonal stumps).

Private nurseries should have access to credit to increase their access to certified budwood and to improve their quality of production in order to meet the demand. They should also be able to provide up to date technical information on clones, as well as general recommendations for clones in terms of fertilization and management according to different types of cropping systems. The private nurseries could be the first link in the network, for information as they provide the most important input: improved planting material.

It seems clear that private nurseries are essential for rapid and efficient diffusion of clones to farmers, on the condition that quality is guaranteed and not lost in the process of mass production. The quality of planting material is affected by both clonal purity (checking of the budwood origin) and size of stumps.
Currently, there is no guarantee of clonal purity for a farmer buying clones from a private nursery, as often an unknown proportion of the budwood used for grafting is not from a clonal origin.

It seems clear that private nurseries could be a crucial factor for faster adoption of clones by local farmers, on the condition that nurseries are provided with certified budwood or can have access to certified clonal plants for their own budwood garden.

A great effort should also be made to increase the DEMAND for high quality and clonally pure planting material. This can only be done by providing reliable technical information to smallholders.

3 Evaluation of production and distribution costs for clonal rubber planting material.

From a survey in one good nursery in Kabupaten Bungo Tebo, the main costs and benefits are the following :

For stumps :

total cost of stump	250 Rp
sale price at farm gate	4 00 Rp
Profit per stump	***150 Rp***

For polybags :

total cost of polybag	400 Rp
Sale price at farm gate GT 1	9 00 Rp
sale price at farm gate other clones	13 00 Rp
Profit per polybag for GT1	***5 00 Rp***
Profit per polybag (other clones)	***9 00 Rp***

It is clear that with such margins, polybag sales are preferred by private nurseries.
It is also clear that recommendations for smallholder development projects should be the purchase of stumps followed by the establishment of a small polybag nursery by farmers, in order to reduce the cost of investment in clonal planting material from 900-1300 Rp/purchased polybag to 450 Rp/polybag produced by farmers.

4 Assessment of purchasing power of smallholders regarding rubber planting material

The analysis of incomes and the source of income shows that capital is not the main constraint for farmers to adopt clones in monoculture or in RAS systems (Rubber Agroforestry Systems). Rubber production, even from jungle rubber, enables farmers to accumulate enough capital to invest in clonal rubber systems at least for a small area such as 0.5 ha every 2 years. The main constraints are in fact the lack of up-to-date technical information available to farmers and private nursery owners, as well as the low availability of clonal planting material.

5. Proposals

General scheme

A programme for budwood production (budwood gardens) at the province level should be organized on the following basis, with *2* main activities :

- Rehabilitation of existing budwood gardens, for the clones that have been selected. This should be done for TCSDP, APBD and PSSP budwood gardens, with 2 clones: BPM 1 and BPM 24. The budwood gardens should be maintained, purified (if possible using the electrophoresis technique, or at least checked visually by technicians from Sembawa), as there is still obviously some mix up, perhaps 10 to 20%, in these 2 clones). The other clones should be removed except GT1.

- *plantation of new* budwood gardens *including the 3 other clones* that are not currently available in the province : PB 260, RRIC 100 and RRIM 600. This could be done by the private sector (with a small credit scheme) or at project level in remote areas.

Organization of the clonal rubber commodity system :

TARGETS/clients

3 main categories of producers should be considered :

- 1 - private nurseries
  - operated by farmers
  - operated by TCSDP/DISBUN staff
- 2 - community managed village budwood garden
- 3 - governmental agencies budwood gardens
  - TCSDP
  - DISBUN

Specific action can be taken for each target group (see later).

ASSISTANCE TO PRIVATE NURSERIES

Quality control supervision and certification process for private nurseries

MULTIPLICATION SHEME

In any case, the system of multiplication should follow the same scheme :

- clear identification of the source of stumps for the establishment of new budwood gardens. All planting material to be used in a new budwood garden should come from a COLLECTION BUDWOOD GARDEN.

The sheme is the following :

Collection BUDWOOD GARDEN ----------> Multiplication BUDWOOD GARDEN----->Satellite BUDWOOD GARDEN

level 1

level 2

- Rehabilitation of existing budwood gardens
- Creation of new BUDWOOD GARDEN

BUDWOOD GARDEN PROTOCOL for establishment

The protocol should be the following :

- no mix-up of clone,
- 2 clones only per private nursery,
- clear separation of blocks between clones,
- correct labelling of blocks and good maintenance,
- planting under the supervision and the responsibility of BIPP, TCSDP or DISBUN staff.
- - Final checking using the electrophoresis technique, on a sample of 10 % of the total plants.
- no seedlings trees allowed in the budwood gardens.

With such system, we ensure the guarantee of origin of the planting material at all level through a right channeling and a permanent control with electrophoresis technique and the continuity of the quality of the system if the system is growing up (extension of satellite budwood gardens) .

In all cases, Quality control supervision and recommendations process for private nursery should be based on the 2 following criterias :

- the respect of satellite budwood garden establishment protocol

- the identification of a maximum production of stumps per clones according to budwood garden capacity (big nurseries) or supply (small nurseries).
A maximum production capacity (number of stumps) will be calculated according to the budwood garden production or to the budwood supplied to the nursery owner.
The production is calculated by taking into account the budwood meterage supplied, or bought, to nursery owners, or on the budwood meterage production, with a grating success rate of 50 %. Basically, 1 plant in a budwood garden can produce the following final amount of stumps :

	YEAR1	YEAR 2	YEAR 3 and later
Maximum production From 1 plant	5 stumps	10 stumps	15 stumps

Conclusion

Budwood garden availability in the Jambi province :

Emphasis should be put on the use of existing rehabilitated budwood gardens.
In the case where there are no existing budwood gardens, new ones should be created in areas where there is a concentration of private nurseries. These new budwood gardens could be established and managed under the supervision of the local association of private nurseries, or directly by the biggest private nurseries. The operator for establishment could be the associations or DISBUN on a contractual basis, provided they follow the budwood establishment protocol.

For big nurseries, it seems essential to help them to establish their own budwood garden ; with certified budwood from collection budwood gardens ***and with a chart based on the protocol formerly presented for all satellite budwood gardens.***
It seems essential to provide technical up-to-date information and training to these private nursery operators in order to maintain a high level of quality in production, and to ensure a correct application of the "certification process".

Quality control of nurseries

In all cases, Quality control supervision and certification/recommendation process for private nurseries should be based on the 2 following criteria :

- adherence to the satellite budwood garden establishment Protocol
- the identification of a maximum production of stumps per clones according to budwood garden capacity (big nurseries) or supply (small nurseries).

Small credit provision for budwood establishment or cash flow assistance should be linked with this quality control process

Technical Information for farmers

The required technical recommendations and information may be disseminated with various types of extension materials: books, leaflets, etc. The role of the Research Centre of Sembawa should be emphasized and supported in the preparation and diffusion of these materials. BIPP should train their extensionists with this new training material or information kits, in particular with respect to types of cropping systems (monoculture and Rubber Agroforestry Systems), and on clone characteristics.

Jambi Regional Development Project
JRDP/World Bank

RUBBER PLANTING MATERIAL

AVAILABILITY AND PRODUCTION

IN JAMBI PROVINCE

TASK 2

Report of a study conducted for the World Bank JRDP, Bogor, March 1998.

Eric Penot
Gede Wibawa
Iwan Komardiwan

CONTENTS

4 Evaluation of production and distribution costs for clonal rubber planting material

5 Assessment of purchasing power of smallholders regarding rubber planting material

6. Proposals

ANNEX

1. Type of rubber planting material : performances of clones, clonal seedlings and polyclonal seedlings.
2. Presentation of the CIRAD Electrophoresis technique for clonal rubber identification
3. Visual checking of clonal purity by Sembawa for PSSP budwood gardens : main results
4. BANDES programme survey: main results
5. Private nursery survey: main results
6. Preliminary survey in Jambi province in 1997, presented at SRAP workshop, September 1997
7. Rubber planting material survey in Jambi province, RIEC/Sembawa, 1990

This study has been prepared by

Eric Penot *1(CIRAD/TERA - ICRAF),

Gede Wibawa *2(*Puslit Karet, Balai Penelititian* Sembawa) and

Iwan Komardiwan *1(ICRAF/SRAP)

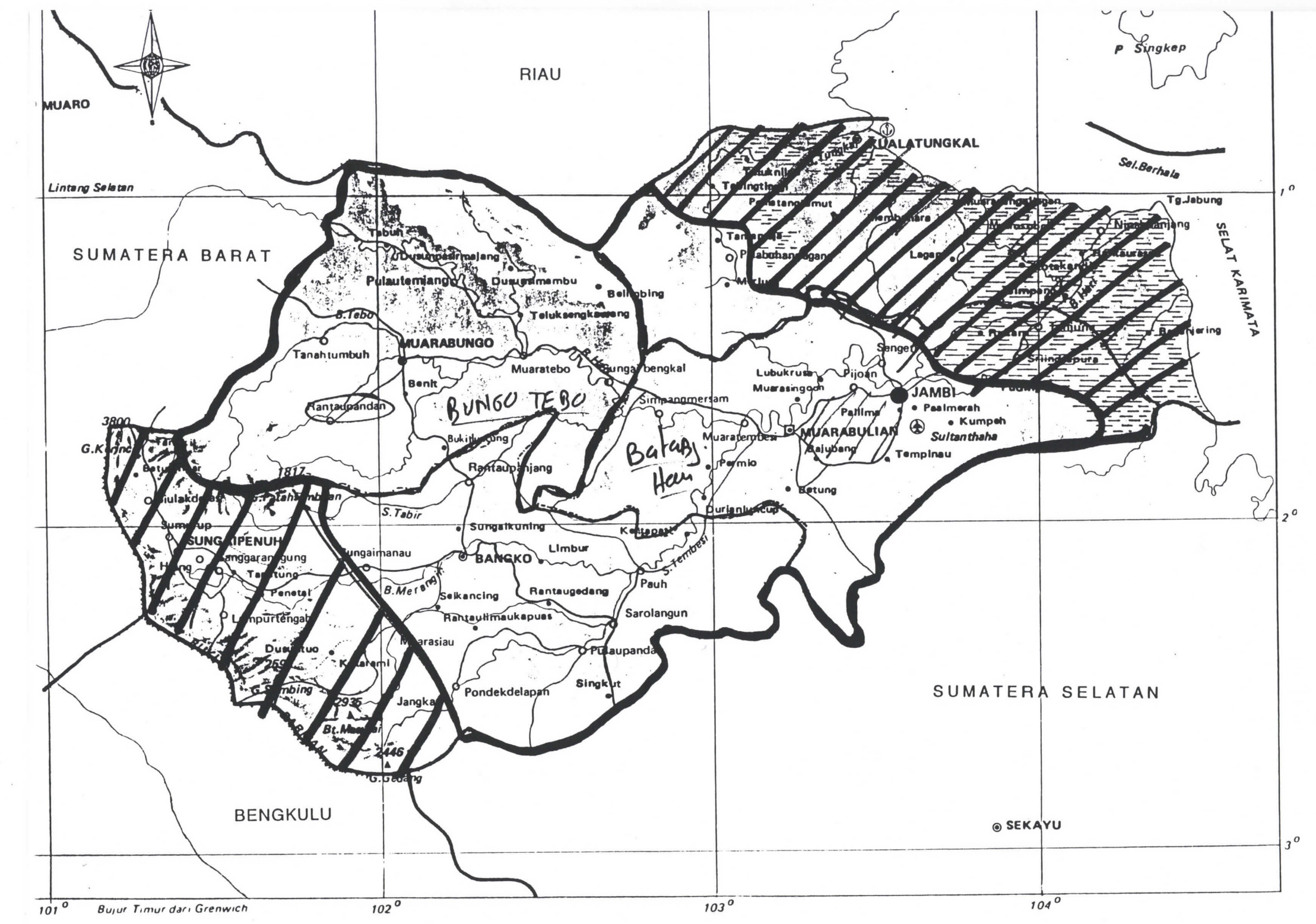
*1 : ICRAF, Jalan Cifor, PO Box 161, Situgede, 16001, Bogor, Fax : 0251 265416 ...
*2 : *Puslit Karet, Balit Sembawa, PO Box 1127, Palembang, Fax : 0711 361793*

The final editing in English of this report has been made by Mss Sandy Williams, ICRAF-University of Bangor (UK).

LIST OF ACRONYMS

AARD	Agency for Agricultural Research and Development
APBN/APBD	Source of funding for DISBUN from GOI.
Bappeda	Planning agency
BPS	Balai Penelitian Sembawa, Rubber Research Center of Sembawa
BLIG	Bah Lias isolated garden
BIPP	New extension organisation (1997/1998)
BANDES	Village development programme
CS	Clonal seedlings planting material.
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement.
CIRAD-CP	CP = Cultures Pérennes = Tree Crop Department of CIRAD.
DISBUN	DINAS PERKEBUNAN (previously Ministry of Agriculture, currently Ministry of Forestry.)
DGE	Directorate General of Estates (Ministry of Forestry)
GOI	Government of Indonesia
GAPKINDO	Union of Indonesian rubber industry.
ICRAF	International Centre for Research in Agroforestry.
IRRDB	International Rubber Research and Development Board.
IRRI	Rubber Research Institute of Indonesia, Sungei Putih.
ICS	Illegitimate clonal seedling
IP2MB	Certification agency in Indonesia.
NES	Nucleus Estates Scheme
PBIG	Prang Besar Isolated garden (from Malaysia)
PTP	Governemental plantations
PSSP	Training project for DISBUN
PCS	Polyclonal seedlings planting material.
PRPTE	Project for Replanting, Rehabilitation and Extension of Export crops.

PMU	Project Management Unit
P2WK	Partial approach rubber development project
P2RT	Rubber development project with former PRPTE farmers.
PPL	Extensionnists
RAS	Rubber Agroforestry System
SRDP	Smallholder Rubber Development Project.
SNI	Indonesian National System for rubber specifications.
SIR	Standard Indonesian Rubber.
TCSDP	Tree Crop Smallholder Development Project.
TSR	Technically Specified Rubber.
TP3D2	Tim Pembina Proyek Perkebunan Daerah Tingkat Dua
WB	World bank


RIAU
MUARO
P. Singkep
KUALATUNGKAL
Sel. Berhala
Lintang Selatan
SUMATERA BARAT
SELAT KARIMATA
Tg. Jabung
Pulautemiang
Dusunpasirmajang
Dusunpasirmambu
Belilubing
Teluksengkaseang
S. Tebo
MUARABUNGO
Tanahtumbuh
Muaratebo
Sungaibengkal
Benit
BUNGO TEBO
Rantaupandan
Simpangmersam
Lubukrusa
Muarasingoch
Pijoan
JAMBI
Pasirmerah
Kumpeh
Sultanthaha
MUARABULIAN
Baiubang
Tempinau
Muaratembesi
Permio
Batang Hari
Batang
Rantaupanjang
Bukitlunjung
S. Tabir
Durianluncup
Sungaikuning
Kelompok
SUNGAIPENUH
Sungaimanau
BANGKO
Limbur
S. Tembesi
Pauh
Sarolangun
Rantaugedang
Selkancing
B. Merangin
Rantaulimaukapuas
Pulaupanda
Singkut
Pondekdelapan
Jangka
SUMATERA SELATAN
BENGKULU
SEKAYU
3800
1817
2935
2446
G. Gedang
101°
Bujur Timur dari Grenwich
102°
103°
104°
1°
2°
3°

RUBBER PLANTING MATERIAL AVAILABILITY AND PRODUCTION IN JAMBI PROVINCE

Introduction

Improved planting material has always been the very first innovation in the process of improving the productivity of cropping systems. Adopting an improved variety generally implies that a certain number of other innovations, or inputs, should be adopted as well, therefore modifying the cropping system to various degrees in terms of required external inputs, costs and labour.

In the case of rubber, adopting clones requires 3 fundamental changes:

- implementation of a relatively comprehensive framework of infrastructure with budwood gardens and rootstock nurseries.
- technical skill for grafting and sufficient technical information concerning the management of a nursery.
- intensification of the traditional rubber cropping system with respect to capital requirements, planting material, additional inputs (fertilisers, herbicides and pesticides) and labour (as the weeding requirements are far higher that that of jungle rubber).

In Indonesia, jungle rubber is the traditional rubber cropping system with very few inputs and almost no labour investment during the immature period. Jungle rubber has enabled hundred of farmers to settle in Sumatra and Kalimantan and to gain a reasonable income since the turn of the century.

However alternative crops (e.g. oil palm) or cropping systems (monoculture) which have a far better productivity are now challenging the jungle rubber system. It is becoming a necessity for many farmers to improve their rubber productivity. As in many other cropping systems, improved planting material is the very first step that allows a significant increase in productivity, generally from 500 kg/ha/year with seedlings in jungle rubber to 1400-2000 kg/ha/year for clonal rubber.

The adoption of rubber clones raises 3 main problems:

- the availability of such planting material
- the quality (clonal purity) of clones
- the technical information required to adopt clones in various systems : monoculture or agroforestry systems (RAS).

The present study will deal mainly with the first two topics.

1 Objectives of the study

The objective of this study is to assess the quality and availability of clonal rubber in the province of Jambi (Sumatra).

After defining precisely what are the different types of planting material available for rubber in general, in the first chapter we will define the team's recommendations for specific clones, and the necessity of using the electrophoresis technique to guarantee the quality of clones at the preliminary multiplication stage.
Chapter 2 will present answers to the first point in our terms of reference- (TOR)

- inventory, evaluation and selection of a few recommended clones to be included in the project, on the basis of: proven yield performance, quick growth, resistance to diseases, tolerance to poor weeding, poor tapping techniques, high frequency tapping, and availability of budwood for multiplication in the Project.

Chapter 3 will expand upon the following:

- inventory and evaluation of the existing government sources of planting material (budwood gardens and nurseries) in and around the Project area, including Dinas Perkebunan, BPP Sembawa and TCSDP nurseries.
- inventory and evaluation of village budwood gardens and nurseries built within government projects
- inventory and evaluation of private nurseries.

- Chapter 4: evaluation of production and distribution costs

- Chapter 5: needs and purchasing power of smallholders regarding rubber planting material

- Chapter 6: proposals

Based on the results, this document presents proposals for a programme for assisting the development of private nurseries and community budwood gardens in the following areas:

- provision of core budwood
- selection of nursery owners ('penangkar')
- technical assistance/training/supervision programme; institutional arrangements
- financing (especially through commercial banks)
- assistance for distribution through village traders
- possible federation of nursery owners under GAPKINDO umbrella with government support
- links with other elements of the tree crop component of the project
- quality control schemes compatible with local practices (i.e. prioritising self-quality control and quality control by the users, and avoiding certification schemes which would be impossible to safely enforce at a local level where certificates could easily be duplicated, or falsified, etc.)

The study area comprises 3 Kabupaten of the Jambi province (see Map 1):

- Kabupaten Batang Hari
- Kabupaten Sarolangun/Bangko or "Sarko"
- Kabupaten Bungo Tebo

The study was based on the following :

- survey of private nurseries (sample of 30, roughly 30 % of the total nurseries)
- survey of BANDES budwood gardens (sample of 30, 10 % of the total)
- survey of all existing governmental budwood gardens and planting material supply projects
- discussion with extension staff, rubber development project staff, farmers and selected private nursery owners

Surveys of private nurseries and the BANDES programme were conducted between January and March 1998. The other surveys were carried out during an appraisal mission in March 1998.

2 Inventory, evaluation and selection of recommended clones to be included in the project

Definition of the types of rubber planting material

It is important to clearly define the types of rubber planting material that are available and the perceptions that farmers have of them. Incorrect perceptions sometimes lead to confusion about the definition of "unggul" or "improved" planting material. We define Improved Genetic Planting Material (IGPM) as improved planting material, referring exclusively in this report, to clones produced by the budding technique.

Various types of rubber planting material are available, depending on the mode of propagation and selection. Definitions for all type of planting materials are given in the following :

- *Unselected seedlings (USS)* are rubber stumps planted directly from unselected seeds or naturally regenerated seedlings collected from jungle rubber.

  It seems that farmers are reluctant to use such planting material for rootstocks (this is certainly the case in West Kalimantan) and prefer to use GT1 seeds, as is widely recommended. One can see the effect of extension workers, and also the fact that GT1 seeds are available from private nurseries of project staff that import them from North Sumatra at a reasonable cost (10 - 12 Rp/seed). It is technically better to use GT1 seeds as rootstocks,.

- *Illegitimate clonal seedlings (ICS*) are trees planted from seeds obtained from natural pollination of a monoclonal plot. GT 1 seeds are generally used for rootstock nurseries.

  Some farmers think that clonal seedlings are already "unggul", or improved planting material which are as good as clones themselves. This is a major misinterpretation, as they expect a production potential as good that as clones (and this is not the case in farmers' conditions). It seems that as a result of the BANDES programme, GT1 seeds were already considered as being "unggul", and therefore the grafting process was not actually necessary. This type of misinterpretation by farmers has been very counter productive.

- *Polyclonal seedlings (PCS)* are obtained from seeds from a polyclonal plot. The only source of PCS in Indonesia is the London Sumatra estate that produces "BLIG" (Bah Lias Isolated Garden) stock.

- C*lones are budded stumps* resulting from vegetative multiplication of one selected individual tree. Clone production requires infrastructure such as budwood gardens and rootstock nurseries as well as technical skill for grafting. Clonal purity is a major issue in clonal rubber development. We will deal mainly with clones in this report.

> It is generally assumed that the grafting success rate is 50 %. 1 meter of budwood provides 10 buds. 1 plant in a budwood garden yields 1 meter of budwood the first year, 2 meters the second year and 3 meters each year after the 3rd year. The life span of a budwood garden is expected to be around 15 years, however this is not generally achieved.

The use of the 3 types of planting materials will be documented here:

a) unselected seedlings (USS) were used by the majority of smallholders and estates at the beginning of the century, and are still widely used by the majority of rubber farmers who have no access to Improved Genetic planting material (IGPM)
b) clonal seedlings (ICS) are no longer used by estates for planting, but are still used by some smallholders (for planting or for rootstocks) and ...
c) the clones

Most farmers without any access to improved planting material still rely on rubber seedlings with inherently low productivity.

Choice of the type of rubber planting material for large scale development

A complete analysis of clones vs BLIG and clonal seedlings is presented in Annex 1.

The BLIG planting material (from London Sumatra estate, North Sumatra) is not considered as a suitable type of planting material for the following reasons :

- high heterogeneity, characteristic of seedling populations
- no particular resistance to leaf diseases, in particular to *Colletotrichum.*
- low productivity in farmers' conditions due to little or no selection (thinning) being practised, which results in many less vigorous plants actually planted in the field.

- cost of seeds to produce 1 valuable plant is equivalent to the cost of a clone (grafted stump), as in theory 1 good plant should be selected from at least 5 seedlings which cost Rp 85/seed (c.f. a clonal stump which costs between 300 and 400 Rp)
- situation of monopoly of the supplier (London Sumatra is the only source in Indonesia)
- no guarantee of quality (no technical means for seed recognition),
- very limited time of seed production (November in North Sumatra)
- low availability of the seeds (very limited production of the 2 BLIG gardens of only 5 hectares)

Figure 1 compares BLIG and clone performances in estate conditions. It should be stressed that there is no indication that BLIG can achieve such yields under smallholder conditions due to the low level of selection.

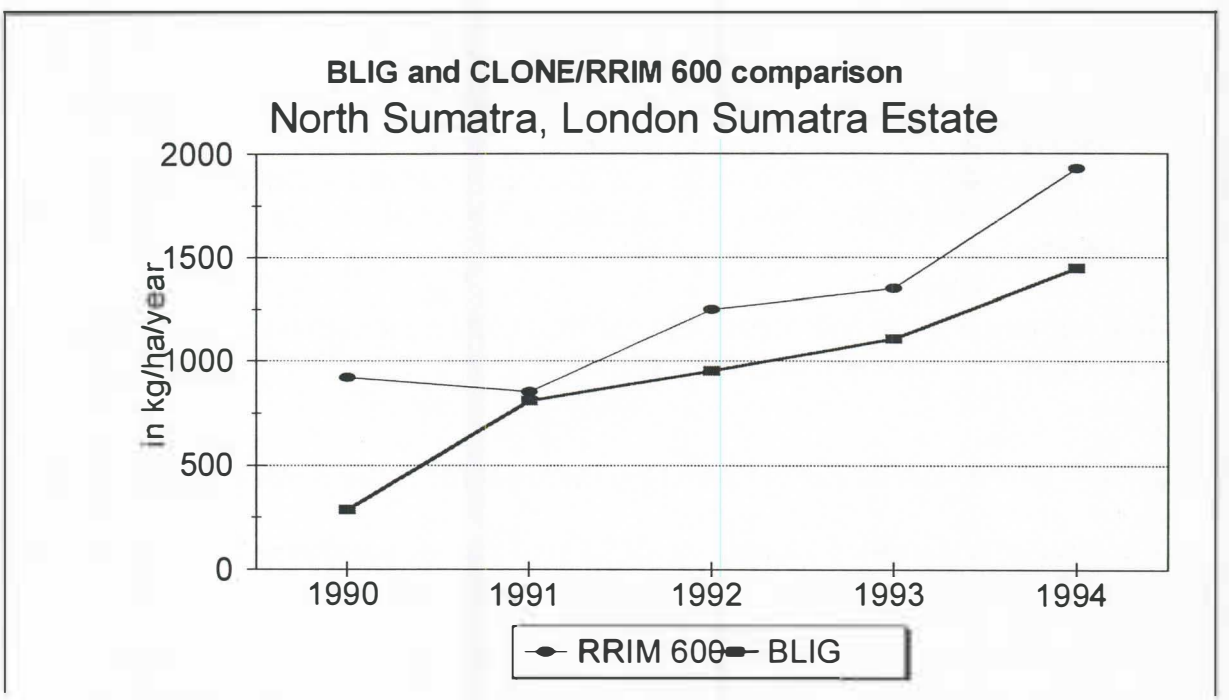


Figure 1. Comparison of BLIG and clone performance under estate conditions.

Therefore, according to the preceding analysis, the only improved planting material that is considered as valuable and cost effective in this report are clones (grafted stumps).
Clonal rubber production needs at least some infrastructure: budwood gardens as a source of budwood for grafting, and nurseries of rootstock plants (to be grafted). The final product is a clonal grafted stump, that can be sold as a stump or planted in a polybag and generally sold with one fully developed whorl of leaves.

Rubber clone recommendations

We fully agree with the Sembawa clonal recommendations for Jambi (Task 2/JRDP, Gede Wibawa, Sembawa). The recommended clones should be the following:

first priority:
RRIC 100
BPM 1
BPM 24
PB 260
RRIM 600

second priority:
GT1

It seems that some geographical areas might suffer slightly from wind damage. In that case RRIM 600 should be avoided as it is a clone clearly susceptible to wind damage.
In the above selection, two clones are susceptible to *Colletotrichum* leaf disease: GT 1 and BPM 24. It seems that, so far, the occurrence of the disease in the province is rather low and does not prevent the use of these 2 clones.
These clones have been selected on the following criteria :

- fast growth, high yield and a quick start in production
- resistance to local diseases (and in particular *Colletotrichum*)
- adaptation to relatively harsh tapping conditions I
- adaptability to low frequency tapping (D3 or D4 instead of D2 currently).

It is assumed that, in the near future (5 to 15 years), smallholders might have to move to low frequency tapping and use of stimulation in order to increase labour productivity. The selected clones allow for that possibility.
Other clones which have already been planted should be avoided, in particular AVROS 2037, all the clones from the PR series (PR 255, PR 261, PR 300...), RRIC 101 and 102, RRIC 110, BPM 107 and 109, the TM series (performance not sufficiently known), and RRIM 712 (too susceptible to *Colletotrichum).*

The clone characteristics are summarised in the clone files in Annex 7. For more information on clones, please refer to the "Rubber Clones Index for Indonesia", (E Penot and R Azwar, 1993, Research Centre of Sembawa).

Rubber clone identification and certification using the electrophoresis technique.

One problem with clones is that visual identification is difficult and not entirely reliable. It has been proven in a report released by CIRAD-CP in 1992 that in Sembawa (after a first demonstration mission), and even with the best technicians, 5 to 10 % of the plants are still obviously not pure. It is clear that although such a rate might be tolerable for some categories of budwood gardens (Level 2, see later), it is not tolerable in collection and Level 1/budwood gardens that are used for the establishment of multiplication budwood gardens in the province. The multiplication factor for error is 30 in a budwood garden, leading to major mix up of clones or errors if collection and Level 1/budwood gardens are not purified.

It is therefore necessary to rely on a fully certified source. The only current reliable means of verifying and certifying clone purity is use of the electrophoresis technique (CIRAD-BIOTROP, see Annex 2).

Therefore a transfer of technology from CIRAD to IRRI/Sembawa seems very necessary to ensure the best quality and purity of the IGPM production network suggested in the later paragraph. The objective in that case is to obtain a 100 % clonal purity in collection and Level 1/budwood gardens.
The transfer of technology is implemented through a technical mission from CIRAD, providing a portable laboratory and full training for electrophoresis analysis and identification over 1 or 2 months. The best institution to implement such clonal purity analysis and control activities seems to be the Research Centre of Sembawa (South Sumatra). Sembawa already has an original budwood collection, all the facilities, and the technicians necessary to implement such activity. Sembawa, as a research station, has also the mandate to guarantee the clonal purity of stumps provided to projects. It is a "neutral" institution that can guarantee the quality of implementation of multiplication and satellite budwood gardens (see in $3).
1 or 2 technicians may be trained and equipped with a relatively small and simple laboratory to perform clonal purity analysis of all required budwood gardens.
The collection budwood garden and the first level multiplication budwood gardens should be entirely checked (100 % of the plants). Satellite multiplication budwood garden can be controlled on a sample basis (10 % of the plants for instance) for verification.

The advantage of such transfer of technology is that the Research Centre of Sembawa, and JRDP in Jambi, can develop a key activity, clonal purity control, that can be extended later to all rubber growing provinces. The sustainability of this activity is largely guaranteed by the amount of work to be done at the national level, and an expected increasing demand for quality by both smallholders and estates in the future.

There is an official institution for certification, the IP2MB. That institution is not yet developed in Jambi province and does not have any specialisation or particular expertise in certification of rubber. We do not believe that this institution can fulfil its role of control and certification for rubber. It is also recommended that an independent agency should operate such control.
Currently, it seems that it is DISBUN which is providing letters of *recommendation*, or contracts with private nurseries. We will see that this situation is not suitable, firstly because DISBUN cannot be at the same time a provider and a controller, and secondly because DISBUN does not have the technology and skills to provide such recommendations.
There is also a special team at the provincial level : the TP3D2 (Tim Pembina Proyek Perkebunan Daerah Tingkat Dua) which is supposed to tackle the problems of plantation projects, in particular planting material, but this exists mainly on paper.

The only improved planting material that is considered as valuable and cost efficient in this report will be the clones (grafted stumps).
Clonal rubber production needs a least some infrastructure: budwood gardens as a source of budwood and rootstock nurseries. The final product is a clonal grafted stump, that can be sold as a stump or planted in a polybag.

The recommended clones should be the following :in first priority : RRIC 100, BPM 1, BPM 24, PB 260, RRIM 600 and in second priority : GT1.

It is necessary to rely on a fully certified and purified source for budwood,.The only current reliable mean to verify and certify the clone purity is to use the electrophoresis technique (CIRAD-BIOTROP). The best institution to implement such clonal purity analysis and control activities seems to be the Research Center of Sembawa (South Sumatra), provided with a collection budwood garden, facilities, and the technicians, to implement such activity. Sembawa, as a research station, has also the mandate to guaranty the clonal purity of stumps provided to projects.
The use of electrophoresis technique is clearly aimed to set up the foundations of a high quality rubber clonal planting material supply system by ensuring clonal purity to the key budwood gardens from which all further plantations will be established.
The use of electrophoresis technique will also enable reliable and unquestionable control of quality and clonal purity over planting material production by projects or private nurseries.

2 A review of the existing sources of IMPROVED PLANTING MATERIAL

Rubber development projects as sources of planting material

Several types of projects have been or are still being implemented in the area with various sources of planting material as displayed in Table 1. We can distinguish 3 types of projects:

- full-package approach : the PMU approach with SRDP, TCSDP (Table 2).
- partial approach : providing to farmers only a limited number of inputs and information for the first year (Table 3).
- Specific projects for planting material supply: village budwood gardens (BANDES), supply of stumps (DISBUN), supply of budwood (PSSP)...(Table 4)

We will focus our study on projects that supply planting material to smallholders.

TABLE 1. TYPE OF RUBBER PROJECTS IN JAMBI PROVINCE

Projects	Objective	Type of approach	Source of funding	Return	Operator
NES/PIR	Plantations for transmigrants	Full-package	GOI/*WB*	Credit	PTP & Transmigrasi
TCSDP	Plantations for local farmers	Full-package	GOI/WB	Credit	DGE
TCSDP BUDWOOD GARDEN desa programme	Supply of budwood garden	Partial	GOI/WB	Grant	DGE
PRPTE	Plantations	Full-package	GOI/*WB*	Credit	DISBUN
P2RT	Plantations	Partial	APBN	Grant	DISBUN
P2RT khusus	Supply of budwood garden	Partial	APBD 2	Grant	DISBUN
P2WK	Plantations	Partial	APBD 1 & 2	Grant	DISBUN
Bandes	Supply of budwood garden + rootstock seeds	Partial	GOI	Grant	PMT
GAPKINDO nursery programme	Supply of nurseries and budwood to farmers' groups	Partial	Gapkindo	Grant	DISBUN
DISBUN PSSP APBD P2KP2	Supply of budwood or stumps Training for staff	Partial	APBN & APBD	Grant and/or sales Free	DISBUN

Note
- APBN funding is at national level and directed by DGE.
- APBD 1 and 2 are provincially funded, operated at Tingkat 1 for APBD 1 (Province) and Tingkat 2 for APBD 2 (Kabupaten)

Table 2. Plantation projects with Full-package approach *:*

Projects	Has developed its own budwood garden?	Source of planting material	Current situation	Pros and cons related to planting material
NES/PIR	No	PTP *V/* North Sumatra (GT 1)	No more plantations	No source of stumps
PRPTE	No	PTP	Project stopped in the 1980's, followed by SRDP TCSDP	No source of stumps (or budwood gardens no more viable)
TCSDP	Yes	Internal	Last planting in 1997	Existing budwood gardens

Table 3. Partial approach projects

Projects	Has developed its own budwood garden?	Source of planting material	Current situation	Pros and cons related to planting material
P2RT /APBN	No	Purchased from contractors (private nurseries)	Still planting	Relying on existing budwood garden used by private nurseries
P2WK /APBD1 & 2 /APBN /OYEK ?	No	Purchased from contractors (private nurseries)	Still planting	Relying on existing budwood garden used by private nurseries
PKT	No	Private nurseries	Still planting	Idem
TCSDP partial	Yes	Internal	No planting in Jambi	No

Table 4 : Planting material supply projects :

Projects	Has developed its own budwood garden?	Source of planting material	Objective	Price
PSSP/APBN DISBUN	YES	internal	sales of budwood	300 Rp per meter
APBD 1 & 2 DISBUN	YES	internal	production of stumps for farmers at subsidised price	125 Rp /stump
P2RT khusus DISBUN/APBN	NO	purchased from contractors (private nurseries)	supply of budwood garden	Free
P2KP2/DISBUN	YES	internal	Training of PPL	Free
Bandes PM*D*	NO	purchased from contractors (private nurseries)	supply of budwood garden + GT 1 seeds for 2 years	Free
GAPKINDO	YES	PT Brahma Bima	Supply of nurseries and budwood	Free Terminated
TCSDP BUDWOOD GARDEN desa programme	no	Contracted to private nurseries	supply of budwood garden. No seeds.	Free

Other sources of planting material : the private nurseries.

We will consider 2 types of private nurseries :

- private nurseries operated by local farmers
- private nurseries operated by TCSDP/DISBUN staff

and

- SRAP budwood gardens (In Muara Bungo area).
- GAPKINDO budwood garden (In Batang Hari area)

One general remark is about the profusion of projects, from partial to full-package approach, with various institutions (DISBUN, TCSDP/DGE, BAPPEDA/PM*D*, PTP/NES/Transmigrasi....) from various sources of funding (APBN, APBD, WB, GOI.....) that has led to a very confused situation. Farmers have access to different types of projects according to their geographical location. They have access to different systems, some with credit to be reimbursed, some with grants with no reimbursement, some with full-package, some with partial approach, some with improved planting material only, and so on.
The situation for the planting material itself is far worse and even more confused, as we will see in the following chapter.

Chapter 2

2.1 Inventory and evaluation of the existing government sources of planting material (budwood gardens and nurseries) in and around the Project area,

Institutional sources:

2.1.1 Dinas Perkebunan,
PSSP/DISBUN
PSSP BUDWOOD GARDEN in Pijoan (Batang Hari)

Area : 2 ha
Clones : BPM 1, BPM 24, PR 261
Date of planting : early 1995
Status : well maintained but not cut every year.
Visual checking by Balit Sembawa technician : YES
Objective : sales of budwood at a subsidised price : 350 Rp/meter (market price is around 700 to 1000 Rp/meter)

This budwood garden can be used directly, only for the BPM 1 and 24 clones. The problem is that the budwood garden, originally aimed to supply the private nurseries, is located 40 km away from the potential users (Sungei Tiga). It is very important that budwood should be used and grafted within 2 days of being cut. Time and transport costs are the 2 main constraints.
It seems that almost nobody in the immediate area is buying budwood (only 200 budwood meters were sold officially in 1997).
Private nursery operators prefer to graft a relatively young half-green budwood (6 months old) and the current available budwood is brown and more than 12 months old (the wood is not cut every year). If the budwood garden aims to supply private nurseries, it should take into account the nursery owners' demands in terms of budwood age and adapt their cutting campaign to the demand.
This budwood garden may be rehabilitated after checking with the electrophoresis technique.

PSSP/DISBUN
PSSP BUDWOOD GARDEN in Desa Langling

Area : 2 ha
Clones : BPM 1, BPM 24, PR 261
Date of planting : early 1995
Status : well maintained, *clone purity must be rechecked*.
Visual checking by Sembawa technician : YES
Objective : sales of budwood at a subsidised price : 350 Rp/meter (market price is around 700 to 1000 Rp/meter). Very few sales; total sales are not clear: apparently 700 meters have been sold, but this figure does not correspond to the actual number provided to one private nursery (?). Potential for production is 45 000 meters/year.
May be rehabilitated for BPM 1 & 24 only.

One of the problems of access to budwood through PSSP for farmers is the long administrative process required to actually buy the budwood.

PSSP BUDWOOD GARDEN in Senamat (Kabupaten *Bungo Tebo*)

Area : 2 ha
Clones : BPM 1, BPM 24, PR 261, total 10200 plants (50 % mortality)
Date of planting : early 1995
Status : well maintained but not cut every year.

Visual checking by Sembawa technician : YES but still 5 % mix up.
Objective : sales of budwood at a subsidised price i.e. 350 Rp/meter (market price is around 700 to 1000 Rp/meter). Sales in 1997: 2 000 meters.

May be rehabilitated for BPM 1 & 24 only.

These 3 budwood gardens have been checked by a technician from Sembawa. Tables are presented in Annex 3 (from a Sembawa report). The main results are the following :

Table 5. Status of PSSP/DISBUN budwood gardens

Clone	PIJOAN			SENAMAT			LANGLING		
	Total	Removed	%	Total	Removed	%	Total	Removed	%
BPM 1	3824	111	3	4190	546	13	4131	251	6
BPM 24	5548	229	5	3115	331	11	3355	332	10
PR 261	5448	136	2.5	3362	460	14	3004	191	6

The table shows that after visual checking, budwood gardens were contaminated by between 2.5 and 14 %. It has been visually estimated by the mission members that there are at least another 5 % of plants that obviously do not conform. This leads to a potential level of contamination between 7 and 20 % which is not acceptable for satellite budwood gardens.

ABPD/DISBUN

Budwood garden APBD in Pijoan

Area: 0.5 ha (the map of the budwood garden has been lost, 7 blocks contain mixed, unidentified clones)
Clones : BPM 1, BPM 24, PR 261
Date of planting : early 1995
Status : maintained but not cut every year.
Visual checking by Sembawa technician : NO
Objective : to supply ABPD projects.

In its current state, the budwood garden is totally unusable as clones/blocks are not identified. A simple visual checking might lead to major mistakes in clone identification. The implementation of that budwood garden illustrates the ability of DISBUN to establish a budwood garden correctly, but its inability to achieve the necessary quality required in terms of clonal purity. The planting material arrived in the fields with a clear identification system (from the Research Centre of Sembawa).

In this case, the use of the electrophoresis technique seems to be an absolute necessity, as visual checking may lead to major mistakes.
This budwood garden has been already used for APBD projects, despite the fact that clones were not identified, which shows clearly the lack of quality control in APBD project implementation. APBD prepares almost 5 ha of rootstock

nurseries every year. One can consider that 1 ha of rootstock nursery may provide planting material for 40 to 50 ha of future rubber plantations. Therefore this is around 200 to 250 hectares that are planted every year with a planting material which is not identified.
APBD projects sell stumps to any farmer (information is provided to farmers by the Camat - the head of administration at the Kecamatan level) at the subsidised price of 125 Rp/stump. Details of this information service are not clear. It seems important that not only the Camat, but all staff from BIPP and BPP should be fully aware of these programmes.

It is obvious that in this case, although the original idea was good (to provide clonal stumps at a subsidised price), the implementation without any criteria of quality and checking leads to the release of inappropriate planting material by those who are supposed to guarantee the quality of such planting material (DISBUN).

Budwood garden APBD in Langling
Area : 0.25
Clones : BPM 1 (1000 plants), PR 261 (1000 plants)
Date of planting : early 1995
Status : maintained
Visual checking by Sembawa technician : NO
Objective : to supply APBD projects : 165 00 plants in 1997 (for 300 ha of plantations).
May be rehabilitated for BPM 1 only

Budwood garden APBD in Senamat (Kabupaten *Bungo Tebo*)
Area : 0.25 ha
Clones : BPM 1, PR 261 (total 4 000 plants)
Date of planting : early 1992 and 1996
Status : maintained and cut every year.
Visual checking by Sembawa technician : NO
Objective : to supply ABPD projects : 120 000 stumps in 1997.
May be rehabilitated for BPM 1 only.

No APBD budwood gardens have been visually checked by Sembawa technicians.

Conclusions regarding APBD/PSSP budwood gardens potential production

Table 6 Estimation for BPM 1 and BPM 24 clones only: potential production per year

Location	PSSP	APBD
Pijoan	9 000	0
Langling	6 900	1000
Senamat	6 500	2000
Total plants	22 400	3 000
Total potential budwood production	67 200	9 000
Total potential production of stumps	336 000	45 000
Total potential planted area/*year*	560 ha	75 ha

The total production potential is rather small with a possible supply of budwood for a maximum of 635 ha per year.

2.1.2 TCSDP budwood gardens

The TCSDP budwood constitutes one of the best sources of planting material, for BPM 1 and BPM 24 only, *but it needs a purification programme*. *These TCSDP budwood gardens have never been purified*. The budwood gardens are still used by farmers and private nurseries (including those of TCSDP staff) but not maintained any more. The lack of proper maintenance may jeopardise the future of these budwood gardens. The potential of these budwood gardens is also rather small (sufficient to establish 1300 ha of plantations per year) and should be fully realized.

Another interesting outcome of the TCSDP project is the technical skill acquired by TCSDP staff and their knowledge of nursery and budwood management. That explains why so many staff have developed their own nursery and it seems to us that this trend should be encouraged in order to actively maintain such reservoirs of knowledge.

Current state of the TCSDP budwood gardens :

Table 7 : TCSDP budwood gardens
Number of plants :

UPP	Area	GT 1	PR 261	*BPM 1*	BPM 24	Total no. of usable plants	Remarks	Rehabilitation
M Tebesi	5		18 500	7 650	22 400	30 050 62 %	BPM 24 is mix up with AVROS.	Possible.
Poorly managed, some seedlings and shoots arising from the rootstock plants, not from the grafted bud. Partially used by local farmers.								
M Tebo	3	45 664				45 664 100 %		GT1 only
Pl Temiang	3		11483	1500 estima-ted	2500 estima-ted		very bad shape, 75 % dead trees	Difficult.
Saro-langun	3	530 + PR 303= 765	9 478		7 500	8 800 44 %	used by local farmers and private nurseries	yes
Pauh	2		3 550	533	9 482	10 015 73 %	not usable any more	no
Total				9 800	41 900			
Estimated potential budwood production				29 400	125 700			
Estimated stump production potential for BPM 1 & 24				147 000	628 500			
Estimated planted area : potential per year for BPM 1 & 24				245 ha	1050 ha			

These figures differs slightly from the official figures that are too optimistic.

2.1.3 NES/PIR

NES/PIR do not have any budwood gardens so there is no possibility of planting extension from the NES itself. However, after several years, NES smallholders develop a sufficient capital from their rubber plots and are ready to plant clonal rubber in their other plots ("lahan tanaman pangan" from Transmigrasi or purchased land). It is clear that NES smallholders now represent a potentially large demand for clonal stumps. Some big private nurseries are supplying these smallholders who have enough capital and prefer to buy planting material rather than grafting it themselves through the BANDES programme. The same conclusion can be reached for TCSDP farmers.
The total area planted to rubber through NES/PIR schemes is 39 300 ha for the Jambi province, with some replanting to be done due to poor status of the first plantations.

2.1.4 The demand for budwood.

Farmers as well as private nursery operators have access to these budwood gardens which are not fully utilised. As we have no estimation of the total number of the nurseries in the province (probably between 80 and 150) and their potential production, it is difficult to assess the overall quality of the planting material provided by these nurseries (and in particular the clonal purity). But locally, we have seen that the amount of available budwood was obviously not sufficient for the production of big nurseries (above 20 000 stumps per year). This means clearly that private nurseries are also supplying "fake clonal stumps" to farmers i.e. stumps grafted with non-clonal buds.

The current maximum potential of budwood supply with BPM 1 & 24 is equivalent to the plantation of 300 ha. If we add to that PR 261 and GT 1 (not recommended), we have a maximum potential of planting of 3 000 ha.
The current area of rubber plantations is more than 500 000 ha in Jambi province, 90 % of which is jungle rubber. This probably includes more than 200 000 ha of old jungle rubber (over 25 years of age) that need to be replanted.
It is obvious that new budwood gardens are required to supply projects, or private nurseries in order to meet this demand.

Conclusion

The situation may be summarized with the following :

- There is NO homogenous policy for planting material supply : budwood is free at P2KP2/DISBUN budwood garden and sold, but subsidized, at PSSP/DISBUN budwood garden. Stumps are sold 125 Rp with P2RT, when there are sold between 250 and 350 Rp by private nurseries. This situation is very confusing for farmers but at least, sources of planting material do exists.

- The process of budwood purchase is rather long and not easy with the necessity to go to the DISBUN office to order and pay before effectively taking the budwood.

- the process of selling subsidized stumps goes through the Camat and some extensionists (PPL). There is obviously a problem of information and distribution

- the total current budwood potential production for the 2 clones among our selection (BPM 1 and BPM 24) is rather small allowing a maximum of 2 000 hectares to be planted each year by farmers with access to these planting material. Some budwood gardens need a serious programme of clonal purification

- the current budwood garden network does not provide the right clones except for BPM 1 and BPM 24. It it therefore necessary, anyway, beside the potential rehabilitation of existing budwood gardens, to plant new budwood gardens with the selected clones , in particular PB 260, RRIC 100 and RRIM 600.

2.2 Inventory and evaluation of village budwood gardens and nurseries built within government projects.

BANDES/INPRES DESA programme (village budwood garden programme)

This programme has been implemented between 1993 and 1995 with the objective of providing most of the villages in the province with a budwood garden to guarantee farmers access to a source of clonal budwood. Selected clones were : PR 261, PB 260 and BPM 1 and in some places GT1. 333 out of the 441 villages have received a budwood garden: 68 villages in Kabupaten Batang Hari (from 250), 115 villages in Kabupaten Sarko and 148 villages in Kabupaten Bungo Tebo.
Officially, a survey implemented by PMD is claiming 65 % success for the BANDES programme. Of course, the analysis depends on how the "success" of the project is defined. Unfortunately, this report was not available.
In terms of outputs for the first 2 years of implementation, the BANDES programme has effectively given access to planting material to a certain number of farmers (see in Annex 4 the total outputs in terms of grafted stumps and seedlings) however the budwood was completely mixed up, and a number of farmers planted the GT1 seedlings directly into their fields, without grafting clonal buds onto them. After the second year, the programme can be considered as a complete failure. The project was obviously not sustainable with a considerable lack of information and lack of quality in implementation.

According to our survey of 30 village BANDES budwood gardens (10 % of the total; see the main results in Annex 5)and visits during the mission, we can assume that less than 5 % of the BANDES budwood gardens are successful and still being used by farmers or private nurseries. This raises the problem of the general lack of monitoring or the quality of the monitoring-evaluation if any. Inherent in this is the lack of quality in implementation and clonal purity. Results presented in this section were collected during the survey.

A number of BANDES budwood gardens were visited in the 3 Kabupaten with generally the same outcome. The budwood garden was used by some members of the community for 2 years, e.g. groups of 15 to 40 farmers in the first year, decreasing in the second year (the period when BANDES also provided GT1 seeds), and then generally not used any more by farmers except for 1 or 2 private nursery owners.

The project has been very poorly implemented with the following features :

- a) most of the budwood gardens are planted on private land (generally the land of the Kepala Desa, the head of the village). As there is effectively only a small area of "Tanah desa" (common village land) available in the Jambi province, it shows clearly the lack of preparation for implementation and the lack of preliminary discussions with local communities : i.e. a general lack of participatory approach which should be an essential feature for such activity. It is questionable how local communities through the various farmers groups (kelompok petani) actually do have access to information at the village level concerning the use and establishment of the budwood garden. Officially, the owner of the land has a contract where he allows other farmers to have access to the budwood garden for 8 years. In practice, this does not seem to be the case.
One of the official reason of the project failure is the lack of farmers' preparation, confirming the lack of participatory approach.

- b) technical implementation: the clonal plants arrived in good condition, the different clones distinctively labelled. Sometimes the plants were accompanied by an extension agent (PPL, including sometimes PPL from DISBUN) sometimes not. However, in practice ALL budwood gardens have been mixed up. It is a matter of organisation: to separate blocks with different clones, and a matter of responsibility. There is clearly a total lack of responsibility in this project, including for technical matters.

- c) after 2 years, the "owner" of the budwood garden generally does not allow farmers to cut the plants in order that he can transform the plot into a productive rubber plot, sometimes after a thinning. It is not clear why farmers do not use the budwood garden after 2 years: is it genuine disinterest or a consequence of this "privatisation" of the budwood gardens? Probably both.

- d) Local extensionists or Kepala Desa (village chief) pretend that the main reason is that BANDES stopped supplying farmers with GT 1 seeds. However, in light of the fact that GT 1 seeds are available from private nursery owners at a reasonable prices (10 to 12 Rp/seed), this does not seem to be a really convincing answer.

- e) the total hectarage planted with clonal stumps from this source is rather limited .

Our survey shows that out of the 30 BANDES budwood gardens, 336 farmers involved in the BANDES programme have grafted their rootstock plants, and 361 farmers actually established plantations with this planting material in the first year (with an average of 0.73 ha planted per farmer). Some farmers external to the BANDES groups have also profited from plants (at no cost).

If we extrapolate to the 330 BANDES budwood garden groups, we can roughly assume that around 4 000 farmers actually did profit, at least for the first year, from the BANDES programme. The total number of stumps and seedlings per village produced are presented in Annex 4. The next table summarise the situation for the first 2 years :

Table 8 : Sample of 30 villages (out of 330 villages in Jambi province). In 1 000 x Number of seeds, seedlings and stumps

	Year 1			Year 2		
Kabupaten	Seeds provided	Used as seedlings	Clonal Stumps	Seeds Provided	Used as seedlings	Clonal Stumps
Batang Hari	215	60.2	81.8	219	59	74
Muara Tebo	325	156.2	26.1	550	184	36
Sarko	850	367.2	49.3	240	102.6	9.4
Total	1 390	583.6	158.2	984	345.6	119.4
%			21 %			26 %
Potential planted area		973 ha	264 ha		576 ha	332 ha

We must realise that most of the seeds have been used directly as GT1 seedlings, as only 23 % of the planting material used was grafted.

The total potential planted area (calculated) is around 2 150 ha for the first 2 years, with an average of 71 hectare per village, from which only 596 ha might actually have been planted with clones, so 20 ha per village only.

The extrapolation for 330 villages gives the following: a potential planted area of 23 700 ha from which only 6 500 ha would have been planted with clones, which is very limited for 2 years.

- f) Farmers invested in their nurseries in particular with fertilisers (not provided by BANDES) as shown in the following table :

Table 9. Fertilisation cost of nurseries from BANDES farmers

In 1000 Rp x	20 to 46	97 to 123	149 to 175	175 to 200
Respondents	7 %	24 %	52 %	17 %

83 % of farmers did 3 to 4 weedings per year in their nursery. No problems of diseases were reported and no pesticides were used. Grafting was usually not done by the farmer himself (90 %). This shows a lack of training in the grafting technique.

The average number of stumps that have been grafted in 1997 by farmers (in fact those who became private nursery owners) still using the budwood garden is the following :

Table 10. No. of stumps grafted by farmers

No. of stumps	1 to 830	830 to 1650	1650 to 2500	3300 to 4200	4200 to 5000
Respondents	39 %	11 %	33 %	6 %	11 %

The main constraint was obviously the lack of grafting skill.

- g) The selection of the villages was done using a very simplistic method: BANDES budwood gardens have been established in villages with PPL (extensionists) and not targeted to villages where the project would have been more appropriate, or where there was a real demand. We will see this feature again in other projects: the project implementation is directly linked with the presence of a PPL in the place. Another criteria was the presence of TCSDP *or* other rubber projects. These areas were considered as the easiest for development. In other words, the programme has been targeted to those who needed it the least, i.e. NES and TCSDP farmers already having sufficient cash flow to buy planting material. It is considered by PPL and DISBUN staff that implementing budwood garden projects in remote areas, or with local farmers is far more difficult, however these are the farmers who need the most technical support. On the other hand, we cannot blame the official extension agency for trying to implement a project with the best chance of success.

The BANDES programme is the expression of a good idea, however where very poor implementation has virtually ruined any chance of success. Lack of relevant information given to smallholder groups, lack of quality in implementation and control by PPL and other staff explains the very poor results of the BANDES programme.

It would be too simplistic to conclude from the BANDES experience that any future village budwood garden programme will fail.

It is clear that some communities need very low cost approaches, in particular those in very remote areas and with very limited capital available for clonal plantation. It is clear also that the amount of work and extension time and the quality of extension are crucial factors in successful implementation. In other words, community based village budwood gardens should be limited to "pilot activities" for some remote locations where traditional sources of planting material are not available. Experience of SRAP in West Kalimantan has shown that in these conditions, organised communities are very interested in village budwood gardens (E Penot, W Shueller, 1997, SRAP Workshop).

A very good result of the BANDES village budwood gardens experience is that there is usually at least 1 private nursery operator per village that remains after 5 years. Unfortunately, these private nurseries operators use a planting material which is totally mixed up. DISBUN conducted a small survey and it seems that there are more than 50 private nurseries now operating, originating from the BANDES programme.
In another case, 20 farmers have established their own budwood gardens, thereby securing access to budwood. One aim of the project might be to help these private nurseries in rehabilitating their own budwood gardens, or more simply, to help them establish new ones with certified clones.

Farmers explain that among other constraints for using clonal stumps in their plantations, one of the most important is the risk of destruction by animals (monkeys, wild pigs and deer). They sometimes consider that GT 1 seedlings are already "unggul" and can be used directly in the field: in that case the cost of any failure is, of course, far less. However potential production is also rather small.
Village budwood gardens may still be considered as an option for remote areas with low or no access to private nurseries, on the condition that a participatory approach is correctly used from the beginning. Only 2 clones should be planted per budwood garden to reduce risks of mix-ups.

Table 11. BANDES budwood gardens visited by the mission

Kabupaten		
Batang Hari	Simpang Kubukandang	Failure, 40 farmers in year 1, partial destruction by pigs in year 3
	Desa Tenam	Failure, 10 farmers in year 1, 20 farmers have made their own budwood garden
	Tanjung Marwo	Failure, appropriation by the "owner", 60 farmers involved during the first 2 years.
	Empela	Relatively successful, the budwood garden is used every year by 7 farmers. On tanah desa.
Sarko	Semaran	Failure, appropriation by the "owner" of the land.
	Senamat	Failure and appropriation. 1 nursery owner is still using a small part of the budwood garden
Bungo Tebo	Printis	Successful : 20 farmers in year 1, 40 farmers in year 2, and still used by local farmers in 1997.

In conclusion, budwood from BANDES is totally unusable (mix-up of clones). Farmers groups or private nurseries still using them, or using small private budwood gardens established with plants from these budwood gardens should be re-supplied with new budwood gardens. The quality of planting material is very bad.
The failure of BANDES programme is due to lack of preparation, information and follow up in the implementation in the long term.
Village budwood gardens have still an interest in particular conditions, such as remote or poor areas, with a sufficient participatory approach.

TCSDP village budwood garden programme

This programme was implemented in 1997 with a target of 100 villages at the national level. 5 budwood gardens have been planted in Jambi, with an area of 0.5 ha each with the following clones : PB 260 and PR 261. Planting material has been obtained from private nurseries with no control or warranty concerning clonal purity. Incidentally, it seems rather strange that TCSDP has sub-contracted planting material supply to private nurseries when TCSDP has all the necessary facilities itself i.e. budwood gardens, nursery and staff. It shows again that quantity has been more important than quality in project implementation. The establishment of budwood gardens assumes at least a guarantee of clonal purity.

In other words, it is recommended to contract planting material to private nurseries for plantation establishment but is NOT recommended for budwood garden establishment. Plants used for budwood garden establishment (multiplication budwood gardens) should be provided by Level 1/budwood gardens in order to secure the origin and quality of the planting material.

The programme is providing a budwood garden but no seeds for rootstocks.
As this programme is rather new, it is a little too early to have any results. Unfortunately, the origin of the planting material is questionable and might lead to poor planting material in terms of clonal purity.
We should therefore rehabilitate these budwood gardens using the electrophoresis technique (checking 100 % of the plants)

Table 12. *TCSDP village budwood garden programme*

Kabupaten	Batang Hari	Bungo Tebo	Sarko
Budwood garden	0.5 ha in Muara Bulian	0.5 ha in Pulau Temiang O.5 ha in Muara Tebo	0.5 ha in Pauh O.5 ha in Sarolangun
	34 farmers in a group for the year 1 may be rehabilitated		budwood garden in Sarolangun is mix up. may be rehabilitated

Half of the area of these budwood gardens is planted with uncertified PB 260 (the other half being clone PR 261 which is not recommended). We can assess that the potential production might be the following :

TOTAL hectarage: 2.5 ha assuming 8 000 plants per ha.
Hectarage of PB 260: *50* %, i.e. 1.25 ha, so 10 000 plants
Potential production of budwood: 30 000 meters after the second year
Potential stump production: 150 000 stumps
Potential area to be planted : 250 ha.

These budwood gardens could be used later on the condition that only PB 260 is used and if there is a check of clonal purity.

conclusion

TCSDP village budwood gardens, however they have been relatively well implemented , might lead to the same outcomes than BANDES if access for farmers is not secured in the long term.
It is NOT recommended to establish budwood gardens with planting material from private nurseries which has not been certified.
Clonal plants used in budwood gardens should be provided by level1/budwood gardens.
The quality of the plants depends of that provided by private nurseries.
The TCSDP budwood garden experience shows that implementation of good quality village budwood garden is possible with a well trained staff.

Conclusion on projects budwood gardens programmes

The situation may be summarized as follows :

- There is NO homogenous policy for planting material supply : budwood is free at P2KP2/DISBUN budwood gardens and sold at subsidized prices at PSSP/DISBUN budwood gardens. Stumps are sold at 125 Rp by P2RT, and between 250 and 350 Rp by private nurseries. This situation is very confusing for farmers but at least, sources of planting material do exist.

- The process of budwood purchase is rather long and not straightforward, involving visits to the DISBUN office to order and pay, before actually taking the budwood.

- The sale of subsidized stumps is organised through the Camat and some extensionists (PPL). There is obviously a problem of information and distribution

- The current potential budwood production for the 2 clones among our selection (BPM 1 and BPM 24) is rather small, allowing a maximum of 2 000 hectares to be planted each year by farmers with access to this planting material. Some budwood gardens need a serious programme of clonal purification

- The current budwood garden network does not provide the recommended clones, except for BPM 1 and BPM 24. It therefore necessary to plant new budwood gardens with the selected clones, (in particular PB 260, RRIC 100 and RRIM 600), in addition to the rehabilitation of existing budwood gardens.

In conclusion, budwood from BANDES is totally unusable (the clones have been mixed up). Farmer groups or private nurseries still using these, or using small private budwood gardens derived from BANDES should be provided with new budwood gardens. The quality of planting material is very bad.
The failure of the BANDES programme is due to a lack of preparation and information during establishment, and also a lack of follow up in the long term.
Development of village budwood gardens still has potential in certain circumstances, such as remote or poor areas, if implemented with a participatory approach.

2.3 The private nursery sector in Jambi province

2.3.1 : visit of some local private nurseries during the mission

2.3.1 Farmers' private nurseries visited by the mission

In the province, 3 areas show a concentration of private nurseries :

- Desa Sungei Tiga, Kabupaten Batang Hari, close to Jambi city (15 km).
- Desa Sumber Agung, Kecamatan Tabir, Kabupaten Sarko
- NES Rimbo Bujang, Desa Sungei Merah and Pelawan Singkut Kabupaten Bungo Tebo.

- Desa Sungei Tiga, Kabupaten Batang Hari *: visit to 2 private nurseries (Pak Rukun and Pak XXX).*
There are around 60 private nurseries in this area (10 % big nurseries and 90 % small), selling stumps of relatively poor quality : poor size (6 to 8 month old stumps with insufficient diameter) and a poor source of budwood. The source of budwood is the old P2KP2[1] budwood garden, originally used for training DISBUN staff and now where free access is given to local users. This budwood garden is an old one, planted in 1981, with an area of 2 ha (16 000 plants) with GT1 and a mixture of other PR series clones. The garden is no longer maintained by DISBUN. Actually, only 0.5 ha of the GT 1 block (av. 1600 plants) is maintained. This budwood garden has never been visually checked by Sembawa technicians.
Except for GT 1, the other clones are not usable. Only 10 % of the plants are actually used for grafting which leads to a potential of 4 800 meters of budwood, so a potential of only 24 000 stumps to be sold which seems to be rather low for 60 private operators. It seems therefore that, besides using other potential sources of budwood (e.g. from BANDES), there is a relatively high proportion of "fake clones" in this production.

Nursery owners seems to be very willing to manage a budwood garden for the group and to have access to credit on a "group liability" basis, for both the establishment of the budwood garden and cash flow assistance for stump production.
The production of the small nurseries, is often collected and sold by the big nurseries..

[1]P2KP2 was a training project for rubber focused DISBUN staff, with a plantation of 100 ha (clone GT 1) and a 2 ha of budwood garden. The plantation is a source of GT1 seeds for rootstock nurseries.

Visit to 1 nursery owner in Tenam, Kabupaten Batang Hari : Pak Mawardi
Mawardi uses some budwood from the BANDES budwood garden but most of the time sells GT 1 seedlings at 250 Rp/plant which is rather expensive compared to clonal stumps usually sold for between 300 and 350 Rp/plant. Farmers prefer to plant seedlings in swampy areas (where clones are considered too fragile). The nursery owner is profiting from this small niche and also, probably, from the lack of information about the real production of GT 1 seedlings. It might be true that seedlings do grow better in swampy areas, anyway, these areas are not recommended for clones.

- Desa Sumber Agung Kecamatan Tabir, Kabupaten Sarko
Private nurseries have directly profited from the DISBUN project of P2RT/Khusus.
Desa Sumber Agung : *Ibu Magdawati* :
1 group of 30 farmers with a BANDES budwood garden divided it into 10 small budwood gardens of 150 plants. Same experience in Singkut.

1 private nursery in Tabir :
Production : 250 000 stumps (potential for planting of 415 ha). The production is bought by DISBUN for P2RT supply. Budwood is from PSSP budwood garden. All clones are mixed up. The planting material provided through P2RT to farmers is therefore not guaranteed at all, and is actually completely mixed up. Stumps are sold at 250 Rp/*stump*. Considering the required meterage of budwood and the actual purchase of budwood, it seems clear that some of the production consists of "fake clones". There is a contract between DISBUN and the nursery owner but nobody cares about its enforcement.

This statement confirm that the best policy is NOT using planting material from private nurseries to establish budwood gardens, at least until planting material origin can be guaranteed.

Visit to a private nursery in Desa Wirdo Agung (NES Rimbo Bujang), Kabupaten Bungo Tebo
A very successful nursery operated by Pak Marjohan who has 2 small budwood gardens. 1 is completely mixed up, however the second one is very well managed (with BPM 1). Both are currently used. The required budwood is taken from the TCSDP budwood garden. 120 000 stumps have been sold in 1997 at the following prices : 350 Rp/stump and 900 Rp/polybag. The NES farmers (Javanese transmigrants) have created a very strong demand for clonal planting material over the last 10 years.

This private operator is very serious and wants to secure his budwood supply by extending his budwood garden with the right clones. The presence of a sustained captive market (first and second generation NES and TCSDP farmers, , who are replanting as well as extending areas of new rubber plantations), and the demand for good quality planting material in size and clonal purity guarantees a return on new investments in budwood production. He also produces oil palm and fruit trees in polybags.

TCSDP/DISBUN staff private nurseries

Desa Tanjung Marwo: Pak Sitanggang, PPL/TCSDP staff. Sitanggang has his own budwood garden with 2 000 plants (PB 260, BPM 24, purity is not guaranteed). Price of 1 stump : 300 Rp.
150 000 stumps have been sold in 1997. He also sells GT 1 seeds at 10 Rp/seed. Budwood is collected from the TCSDP budwood gardens.

Desa Pauh : The TCSDP staff have created a kind of private co-operative to import GT 1 seeds from Medan. Seeds are shipped at Rp 7.5/seed, transport included, and sold at Rp 12/seed. If seeds are used as rootstocks, it is a good *initiative* . However, farmers might be confused, assuming that GT1 seeds are "unggul", and therefore using them directly as seedlings. This group has sold 100 000 seeds and 100 000 clonal stumps in 1997 (budwood from TCSDP)

2.3.2 Main results from a survey of 30 private nurseries in the province

A preliminary survey conducted in May 1996 by ICRAF is presented in Annex 6 (Iwan Komardiwan and E Penot, SRAP workshop, Sept 1997).
We can clearly see the increase in production of stumps, reflecting on one hand a large demand for clones, and on the other, an emerging and very dynamic private nursery sector.

Table 13. Farmers' private nurseries production in Kabupaten Bungo Tebo

Year	No. of farmers selling stumps and polybags		Average production of stumps / polybags		Total Production of stumps / polybags		Price (Rp) per stump / polybag	
1991	4	2	10,500	3,000	42,000	6,000	175	650
1992	4	2	10,500	3,000	42,000	6,000	175	650
1993	4	2	10,500	3,000	42,000	6,000	175	650
1994	5	4	10,800	3,000	54,000	12,000	200	700
1995	7	5	11,000	3,800	77,000	19,000	250	750
1996	7	6	12,430	3,830	87,000	23,000	250	750

Source : Results from interviews, May 1996, SRAP.

In this area in Kabupaten Bungo Tebo (Muara Bungo), the production has doubled between 1991 and 1996.

Table 14. Production of farmers' private nurseries in Batang Hari

Year	No. of farmers selling stumps / polybags		Average production of stumps / polybags		Total production of stumps / polybags		Price (Rp) per stump / polybag	
1988	2	-	7,750	-	15,500	-	125	-
1989	2	-	10,250	-	20,500	-	100	-
1990	4	1	14,375	2,000	57,500	2,000	100	400
1991	4	1	27,250	2,000	109,000	2,000	125	450
1992	6	1	31,665	2,000	190,000	2,000	130	500
1993	6	4	41,666	13,750	250,000	55,000	150	550
1994	7	7	47,857	31,071	335,000	217,500	150	600
1995	8	7	32,750	18,500	262,000	129,500	175	650
1996	8	8	43,750	11,562	350,000	92,500	200	700

Source : Results from interviews, May 1996, SRAP.

In Kabupaten Batang Hari (Desa Sungei Tiga), the production has tripled between 1991 and 1996. One can see that stump price is slightly lower in Batang Hari than in Muara Bungo. The demand is also larger.

In 1996, DISBUN assessed the number of private nurseries as follows:

Table 15. No. of private nurseries

Regency Kabupaten	No. of farmers operating a nursery Assessed by DISBUN	Real number assessed by ICRAF/SRAP in 1996
Batang Hari	23	> 50
Bungo Tebo	5	> 10
Sarko	12	> 15

The real number of private nurseries is not known but this number is undoubtedly increasing every year following the increase in demand.

A second survey was implemented by the consultants (and ICRAF) between January and March 1998 on 30 private nurseries (3 Kabupaten, 7 Kecamatan and 14 villages) . It aimed to obtain more detailed information about private nursery activities, and in particular to assess stump production, the origin of the budwood, the production costs and the cultural practices, as well as an assessment of owner's knowledge about clones.

The full outputs from the survey are presented in Annex 5 (data have been processed with Winstat a french software developed by CIRAD).

The main features of the private nursery survey are the following :

Ethnic origin and age of owners :

- 67 % of the owners are Javanese, 10 % Minang and only 10 % are local Melayu.
- 73 % are between 24 and 50 years old. No female farmers are operating a nursery.

Nursery activity is clearly due to Javanese spontaneous transmigrant farmers as well as, in some cases, farmers from the official Transmigration programme (in Rimbo Bujang). .

Type and cost of land used for nurseries :

- 60 % implement the nursery on their own land but 33 % borrow the land without any cost. If land is rented, the cost is very small, being less than 10 000 Rp/year;
- 57 % of the nurseries have been established on bushland (young secondary forest regrowth) and 40 % on land with *Imperata cylindrica*.
- 53 % do not have access to any source of water for irrigation and rely only on rainfall. This leads to relatively poorly developed stumps at the age of 8 months. 37 % use a well for irrigation.

Land is not a constraint as nurseries and budwood gardens do not require a large area (less than an hectare for small and medium sized nurseries).

Staff

- 70 % have only 1 or 2 staff working in the nursery, with 90 % part time staff and only 47 % with 1 permanent member of staff, showing that most of the nurseries are operated by families on a relatively small scale.
- 20 % have between 3 and 6 permanent staff: these represent the large scale nurseries (7 % have around 20 part time staff).

Budwood garden

- 67 % do not have a private budwood garden and rely on external source for budwood:

27 % use P2KP2 budwood garden (Desa Sungei Tiga),
27 % use BANDES budwood garden,
20 % use TCSDP budwood garden and
7 % use other budwood gardens. N

No respondents used the PSSP budwood gardens.

This is a very important point : nurseries must have their own budwood gardens in order to secure their budwood supply, limit the cost in terms of transport, labour, quantity of budwood and risks. Budwood garden acquisition should be supported, mainly by providing them with certified planting material at low cost.

- Among those who have a budwood garden, 47 % intend to increase their budwood garden area to secure their budwood supply : 20 % with PB 260, 23 % with BPM 1 , 10 % with BPM 24, 13 % with RRIM 600 and 7 % with RRIC 100 (the recommended clones).

The big nursery owners are responding to the demand for new clones that perform better than GT 1. Diversification with the recommended clones should be supported.

- Origin of the budwood : 53 % did not answer, showing that there is a real problem of budwood supply. 36 % were supplied from the Sembawa area (Research Centre or more often from surrounding private nurseries), the rest from various other local sources. Sembawa area is obviously still a great supplier.

This shows that budwood is scarce. The supply is not secure. There is an obvious lack of information on clones. This is also probably due to budwood scarcity or cost, the production of "fake clones", budded with anything but clonal budwood.

Choice of clone and quality of information on clone characteristics

- 54 % claim that they had no choice but to use the closest source of budwood.: This indicates a problem of availability (proximity), and/or lack of information. 27 % have been advised by DISBUN.

- 67 % claim they know about these clones, but precise information about them is weak.

There is a clear lack of technical information on clones and the use of clones in cropping systems.

- 47 % had information from official sources, mainly DISBUN and TCSDP (71 %).

Still, 53 % of the nursery owners multiply so called clonal planting material without any idea about the type of clones they sell.

- 33 % do not answer about specific clone characteristics (lack of information) and 17 % do not have any information at all; basically only 50 % have some technical knowledge about clones. This information is limited to growth and yield. NO-ONE knows about resistance to disease or other secondary characteristics. Technical information is weak and unreliable. 86 % had information on clones from official institutions concerning secondary characteristics (resistance to diseases etc).

- 100 % claim they can recognise clones. However most of the budwood gardens are at least partly mixed up. Most nurseries sell only "unggul " plants without any knowledge of the type of clones. This shows that nursery owners in reality DO NOT recognise clones. They do not want to acknowledge that they cannot recognise clones because of a lack of information. The lack of quality demand from buyers is probably responsible for that situation. On the other hand, 53 % can see some differences between plants, recognising indirectly the mix-up of clones.

- 90 % do not make any selection or purification to eliminate the "bad" clones, even if recognised in their field.

This shows that there is NO quality control at all in private nurseries, and this situation is sustained by a demand from buyers who are not well informed about what they purchase.

- 97 % do not know why there are so many clones, and the differences between them. There is a clear lack of reliable and easily accessible technical information on clones. On the other hand, 87 % of respondents claim that some clones are more suited than others to some areas. They mention first clones like GT1, 53 % (in fact the most widely planted), followed by clones such as BPM 1(16 %), BPM 24 (13 %) and PR 261 (13 %). In fact, they mention the clones that are actually available at the moment. In other words, no private nursery owners have a clear idea of clone characteristics. Those who might have some knowledge are probably TCSDP staff operating nurseries, but even in that case, the quality of knowledge is rather inadequate.

- If asked about characteristics that make these clones more adapted to the area : 40 % mentioned growth, 35 % said "it is suitable" but only 4 % mentioned resistance to disease for instance.

It is absolutely clear that technical information on clones is necessary through the dispersal of up to date leaflets or field books for private nurseries owners, so that they are firstly able to know their own production, and secondly to publicise this information to their clients.

- For rubber monoculture : 90 % claim that GT1 is the best clone (because it is the most widely planted). There is not enough planting of other clones and visual experience , so far, to enable owners to develop a clear opinion on clones. No one had any idea about clonal rubber in agroforestry systems. No one also had a clear idea of what an agroforestry system actually is, although they have usually practised this for years with their own jungle rubber.

There is no clear knowledge on which clones suit particular cropping systems. Farmers mention monoculture because it is the only system that has been developed with clones though projects.

- 7 % have heard about polyclonal seedlings : 50 % mentioned BLIG and another 50 % mentioned "other". We should be concerned about what this "other" PCS planting material could actually be, and where it is coming from!

It appears that PTP 6 is importing PBIG polyclonal seedlings from Malaysia but it is not clear if farmers were referring to that possibility. In fact, it seems that they do no not exactly what these polyclonal seedlings are. This shows the state of confusion for many small private nurseries owners about the definition of the word "unggul" ("improved").

This confirms that use of polyclonal seedling (PCS) planting material could be very dangerous, as anybody could claim to be selling PCS with unselected seeds as there is no technical means to verify planting material purity. 1 owner claims to have bought PBIG from Malaysia. No information was given on price. Regarding differences between polyclonal seedlings and clones, 80 % (of 5 owners) mentioned a better growth for these polyclonal seedlings.

- 73 % do not really know what the best rubber planting material is, but 100 % of the 23 % who did respond mentioned clones (83 % of these mentioned the high production as the first advantage).

- 80 % did not answer , i.e. did not know, about the demand from farmers.

Budwood garden and Nursery implementation : agronomic features and costs
(Technical information is available in Annex 5.)

- 80 % have a nursery area comprising between 0.1 and 0.6 hectare. 83 % use GT1 seeds for rootstocks following standard recommendations.

The use of GT1 seeds seems to be widely used : this is very favourable.

- 20 % only use fertilisers on budwood garden and 100 % on rootstock nurseries, in particular urea (100 %), SP 36 (73 %) and KCl(50 %).

The lack of use of fertilisers in the rootstock nursery surely has an impact on plant growth. The result is the sale of small, thin stumps that do not growing well in the fields, and are more susceptible to drought or competition from weeds.

The use of fertilisers in rootstock nursery should be promoted to guarantee thick stumps.

- 30 % only weed the budwood garden properly (89 % of these weed manually). If herbicide is used, Gramoxone was mentioned by 1 owner.

ERIC! I guess one of these should be rootstock garden??

- 90 % weed the budwood garden properly (90 % manually). If herbicide is used, Glyphosate based herbicide was mentioned by 3 owners. 89 % required between 10 and 30 mandays for weeding per year.

The use of herbicides seems to be still very limited in budwood gardens. Weeding is mainly done by hand.

- 50 % do not answer the question about diseases and 93 % claim they do not have any disease in budwood gardens.

That might indicate that *Colletotrichum* leaf disease in particular does not seem to be a constraint but this should be verified. Just because a constraint is not mentioned or recognised, it does not mean that it does not exist. 20 % of respondents applied pesticides, which is not consistent with 93 % mentioning the lack of disease, however these pesticides may be used in a preventive way. Dithane M45 has been mentioned by 10 % (confirming that the risk might be *Colletotrichum*). 87 % do not apply any pesticide to nurseries (if any, Dithane M45 is used with 1 or 2 treatments only).

Grafting and grafters :

- 61 % have 1 or 2 full time grafters (usually a member of the family as 82 % do not employ any external grafters), 32 % between 3 and 4, and 7 % around 10 grafters (large scale nursery).

- The average output for grafters is 150 to 300 grafts/day (60 %) or 300 to 500/day (33 %). All grafters are paid 40 to 70 Rp/successful graft.

- The grafting skill has been acquired in all type of projects (26 % from DISBUN).

Table 16. Age of the plant when grafted

Age of rootstock in months	3	5	6	7	8	9
Respondent	4 %	15 %	33 %	22 %	4 %	22 %

If only 4 % do green budding, the age of stumps is relatively young, confirming that owners and grafters generally prefer young budding to brown budding.

Cost of plastic for grafting: 40 % mentioned 7 to 25 000 Rp/year and 46 % 25 to 45 000 Rp/year.

- 60 % wait less than 3 weeks before checking for grafting success The recommendation is between 3 and 4 weeks.
- 80 % leave the plant in the nursery for only 1 month after grafting. It shows that plants are sold and removed as soon as the graft is checked. There is no further growth of the plant in nursery after grafting.

SALES OF PLANTING MATERIAL

- 85 % of owners sell stumps in polybag at the stage of one whorl.
- 76 % sell stumps and 80 % sell polybags.

This confirms that there is a market for both types of production : stumps and polybag. Budwood is not sold by private nurseries. Emphasis should be put on both sale of stumps for poor or middle-revenue farmers (with later use of polybags at the farm) and sale of polybagged stumps for farmers who can afford it.

- The estimated production cost for a stump is between 50 and 100 Rp in extensive nurseries and between 150 and 250 Rp in good nurseries.
- The estimated production cost for a polybag is between 250 and 400 Rp (55 %).
- 87 % sell to farmers (up to 250 plants/farmer on average) and 10 % to government projects (only 1 nursery sells to a private estate)

Most farmers buying clones plant them in a monoculture system : at least for the first years in order to secure the growth of rubber plants. After 3 or 4 years, some may shift to various types of agroforestry systems.

- **Average annual sales** :

NUMBER OF STUMPS

Table 17. Annual sales from nurseries (number of stumps)

Number	1 to 14 300	14 300 to 28 600	28 600 to 43 000	43 000 to 57 000	85 000 to 100 000
Respondent	82 %	3.6 %	7.1 %	3.6 %	3.6 %

Most small nurseries sell only stumps, with less than 15 000/year.

NUMBER OF POLYBAGS

Table 18. Annual sales from nurseries (number of polybags)

Number	1 to 2 850	2 850 to 5 700	5 700 to 8 600	8 600 to 11 500	17 000 to 20 000
Respondent	39 %	29 %	25 %	3.6 %	3.6 %

Most of the nurseries sell a relatively small number of polybags (93 % sell less than 8 500 /year). This is explained by the higher cost of planting material in polybag; approximately 3 times more expensive than stumps. Generally, this type of planting material is purchased by local small investors.

AVERAGE ANNUAL SALES of nurseries

Table 19. Annual turnover of nurseries (millions of Rp)

SALES in millions Rp	0.3 to 4	4 to 7.6	11 to 15	22 to 26
Respondent	57 %	32 %	3.6 %	7.1 %

Most of the small nurseries have an total sales of between 0.3 and 4 million Rp/year, from which at least 50 to 60 % might be considered as profit.

ESTIMATED ANNUAL PROFIT

Table 20. Estimated annual nursery profit (millions of Rp)

PROFIT In millions Rp	0.1 to 2.6	2.6 to 5	7.5 to 10	15 to 17.5
Respondent	68 %	21 %	4 %	7 %

The range of annual profits would enable private nurseries owners to reimburse within a year a small amount of credit , 250 000 to 400 000 Rp for instance , if this was available for investment in their own budwood garden.

This also shows that nursery activity is still embryonic in Jambi. Most of the nurseries are small nurseries, sometimes selling their small production to bigger nurseries. However, this shows also that there is a potential for development, as the market is growing.

Farm gate prices for planting material :
- Stumps : 250 to 350 Rp.
- Polybags : see Table 21

Table 21. Price per polybagged clone (Rp)

Price	500 to 630	630 to 750	750 to 900	1100 to 1300
Respondent	33 %	42 %	21 %	4 %

The main constraint for private nurseries remains access to good quality budwood, either through the establishment of their own budwood garden with certified plants (and the annual profit ranges permit the reimbursement of a small credit for budwood garden establishment) or through access to projects' certified budwood gardens.

2.3.3 Anne Gouyon's study in 1990 and comparison with the current situation

Anne Gouyon (IDéFORCE) conducted a similar study in 1990 for RIEC/Sembawa and GAPKINDO. She surveyed 90 villages in the 3 Kabupaten.
She was already stating that DISBUN projects for supplying farmers with subsidised stumps were not very effective, as the demand was scattered and the transport cost high compared to stump price (Rp 100). We can also note that the current subsidised price is Rp 125, which show a very small price increase in 8 years.
One of her main conclusions was that farmers were quite reluctant to take the risks to invest in clones (this is obviously no longer the case), and that most of them were adopting GT 1 seedlings. On the other hand, she observed that migrants were more keen to adopt clones, and this is still true as most of them have been well informed about clones and had access to clonal plantations through NES schemes.

The private nursery sector was very new and emerging in particular :

- in Margoyoso (Kab Sarko), sales of GT 1 seedlings (Rp 15-50/seed). The current price is Rp 10 to 12 (no change in 8 years).

- in Pondok Medja (Kab Batang Hari): there were 30 nurseries. 80 % of which were producing GT 1 seedlings.

Evolution of planting material prices between 1990 and 1998

Table 22. Evolution of planting material prices between 1990 and 1998 (Rp)

Type of planting material	Price in 1990	Price in 1998
Seeds	10	10 to 12
GT 1 seedlings	50 to 100	100 to 250
Grafted clones	100 to 150	250 to 350

The demand was more oriented towards seedlings. In 1998, the demand is now clearly for clones. Prices have been very stable for seeds. The price increase is lower than that of inflation, indicating that clonal rubber planting material is less expensive in 1998 than in 1990, therefore more affordable for farmers.

- in NES Rimbo Bujang :migrants operated nurseries mainly selling GT1 seedlings.

If the demand was more oriented to GT1 seedlings in 1990, it is clear that now, in 1998, the demand is clearly focused on clones as a result of the presence of the various rubber development projects in the area. But still, most farmers , and even most private nursery owners do not have a clear idea of what the differences between clones are. The demand is still quantitative and not qualitative. The demand is focused on "unggul", a generic term for improved planting material.

Conclusions on private nurseries

Concentrations of private nurseries in some areas will be easier to improve as soon as they have access to a reliable source of budwood which is the key question in the clonal rubber planting material commodity system. Scattered private nurseries should also have access to good quality budwood or be given the possibility of establishing their own budwood garden. In any case, the development of a private budwood garden with certified plants is highly recommended. I there is a common source of well checked budwood, it will be easier for annual certification of the production.

Nursery owners are potentially a reservoir of grafting skills and in the case of TCSDP staff, a source of relatively reliable information.
A credit scheme based on "group liability" seems to be suitable, with a reimbursement of the credit within a year, or 18 months in the case of production of stumps of 18 months.
Certification process, on an annual basis should be linked with credit provision.

To summarise concerning private nurseries, the needs are the following :

- to provide up-to-date information in terms of clone performances and recommendations.
- to train small nurseries owners in budwood garden establishment, and budwood garden and nursery management in order to produce good quality planting material.
- to support the establishment of private budwood gardens with certified planting material coming from Multiplication /level 1 budwood gardens.
- to limit the number of clones to 2 for small nurseries and balance the clone distribution per area. Following the right clone recommendations is essential to choose clones suited to local conditions.
- to establish fully certified satellite budwood gardens in remote areas to provide access to budwood to small nurseries, operated initially by DISBUN and Nursery owners, and then by nursery owners after 3 years, and reimbursement of the credit.
- to support any genuine organisation of private nursery owners with technical information, as well as granting access to certified budwood gardens.

Private nurseries are obviously the best way to meet the demand at the condition that stumps production is controlled in quantity (according to the certified clonal budwood production or supply) and in quality (certified budwood).

Private nurseries should have access to credit to increase their access to certified budwood and improve their quality of production in order to meet the demand. They should also be able to provide up to date technical information on clones as well as general requirement for clones in terms of fertilization and management according to different types of cropping systems. The private nurseries might constitute the first shackle of the network for information as they provide the most important input: improved planting material.

It seems clear that private nurseries are essential for a rapid and efficient diffusion of clones to farmers at the condition that quality is guaranteed and not lost in the process of mass production. The quality of planting material concerns both clonal purity (checking of the budwood origin) and size of stumps.

Currently, there is no guarantee for a farmer buying clones in a private nursery concerning clonal purity as an unknown part of the budwood used for grafting is not from a clonal origin.

It seems clear that private nurseries might be a factor of faster adoption of clones by local farmers at the condition that nurseries are provided with certified budwood or can have access to certified clonal plants for their own budwood garden.

A great effort should be put also on the demand sector, on the technical information to smallholders in order to create a demand on quality and clonal purity.

2.4 GAPKINDO budwood garden in PT Brahma Bina Bakti

The budwood garden is no longer in use and cannot be rehabilitated as it has been transformed into a production plot. Originally, the budwood garden was established in 1993 (see more information in Annex 6)

2.5 SRAP budwood garden programme

SRAP, a rather small scale research project from GAPKINDO/CIRAD/ICRAF/Research Centre of Sembawa has established 3 budwood gardens with 4 clones (PB 260, RRIC 100, RRIM 600 and BPM 1) in 1996 :

- in Muara Bungo agricultural school (SMTP) that is well maintained and can be used as a reliable source of budwood
- In Rantau Pandan, a private nursery owner (Pak Abu Bakar)
- In Muara Bungo/Simpang Babeko, a private nursery owner, Pak Holik, already providing GT1 of a good quality.

These budwood gardens have been established with planting material directly imported from the Dolok Merangir GOODYEAR plantation that can be considered as one of the most reliable sources of budwood and certified clonal stumps with the Research Centre of Sembawa (South Sumatra). Each budwood garden has 100 plants of each clone, with an annual production potential of 6 000 plants (for 10 hectares).
They can be used later by JRDP as "Multiplication/level 1 budwood gardens ".

3 Evaluation of production and distribution costs of clonal rubber planting material

Production costs are derived from the survey implemented by the consultants (and ICRAF) between January and March 1998 on 30 private nurseries (3 Kabupaten, 7 Kecamatan and 14 villages). (The total outputs from the survey are presented in Annex 5). Note : prices are those before the 1997/98 crisis.

COSTS

- *Cost of seeds:*

Table 23. Seed price (Rp)

Seed price	1 Rp	2 to 5 Rp	6 to 9 Rp	10 Rp 13 Rp
Respondents	40 %	20 %	13 %	23 %

The average price of GT1 seeds in March 1998 is 10 Rp/seed. The 40% of respondents buying seeds at 1 Rp/seed suggests that many nurseries are still being established with local seeds collected in jungle rubber.

Cost of nursery fertilisation :

- UREA : 80 % claim an average expense of between 10 and 30 000 Rp/year. Only 3 % have expenses of between 100 and 120 000 Rp/year (large scale nursery).
- SP 36 : 73 % claim an average expense of between 10 and 54 000 Rp/year. 18 % have expenses of between 55 and 84 000 Rp/year (large scale nursery) and 9 % between 85 and 174 000 Rp/year.
- KCl : 67 % claim an average expense of between 10 and 30 000 Rp/year. Only 34 % have expenses of between 46 and 75 000 Rp/year (large scale nursery).

Fertilisation is still not widely used, or used in lower proportions than the actual field requirement.

Cost of labour for weeding
- 82 % mentioned 1000 Rp/day, suggesting it might be family labour. 18 % mentioned a manday cost between 4 and 9 000 Rp/day that corresponds to a normal wage for employed staff (large nursery). In March 1998, the average daily wage is 7500 Rp/day.

Cost of pesticides
- 1 owner with 2 000 Rp/year and 3 owners with 15 to 20 000 Rp/year.

Few pesticides are currently used (mainly Dithane M 45 against *Colletotrichum* disease.). Local seed seems to be more resistant to that leaf disease. It should be noted that the recommended GT1 seedling for rootstocks is susceptible to *Colletotrichum* and should be treated in the nursery. The relatively low use of pesticides confirm the use of local seeds for many nurseries.

Cost of plastic
Cost of plastic for grafting : 40 % mentioned 7 to 25 000 Rp/year and 46 % 25 to 45 000 Rp/year.
This is a relatively important cost.

Farm gate prices for planting material :

- Stumps : 250 to 350 Rp. The average price in March 1998 is 350 Rp/stump.
- Polybag : between 500 to 1300 Rp. The average price is 9 00 Rp/polybag.

Table 24

Price	500 to 630	630 to 750	750 to 900	1100 to 1300
Respondent	33 %	42 %	21 %	4 %

In conclusion we can present the case of Pak Holik's nursery (supported by SRAP) that can be considered as a perfect case study for a pilot nursery.

Example of a pilot private nursery : Pak Holik's nursery in Simpang Babeko

The nursery is located close to Muara Bungo. In the 1990's Pak Holik received support from DISBUN to establish a budwood garden with 1 clone (GT1). In 1996, SRAP provided him with another set of plants with 4 clones (recommended by the project), with 100 plants per clone. The selected clones are PB 260, RRIC 100, BPM 1 and RRIM 600.

Total annual production

In 1997/98, the total sales are the following :
- 6 000 rubber plants in polybags of the 4 SRAP clones sold at 1300 Rp/plant
- 4 000 rubber plants in polybags with GT1 sold at 900 Rp/plant
- 3 000 stumps of various clones sold at 400 Rp/stump.

The total sales are 10 000 polybags and 3 000 stumps for one year. The capacity of production of the nursery is 6 000 plants of the 4 SRAP clones and more than 10000 plants of GT1.

This production has been sold to 60 farmers with the following distribution: :

Table 16. Number of plants purchased per farmer

50 to 200	200 to 400	400 to 500	Above 600
32	15	10	3
53 %	25 %	17 %	5 %

Cost of production of stumps

The breakdown of the cost is the following :

- bud from budwood :	20 Rp	8 %
- plastic for grafting :	70 Rp	28 %
- GT1 seeds (2)	20 Rp	8 %
- fertilisers in nursery	60 Rp	24 %
- labour and herbicides in nursery	30 Rp	12 %
- grafting cost	50 Rp	20 %
total cost of stump	250 Rp	
sale price at farm gate	4 00 Rp	
Gross margin per stump	***150 Rp***	

Some comments on stump production costs.

Fertilisation cost for 10 000 rootstock plants in nursery :

1 application :
50 Kg of urea x 700 Rp = 35 000 Rp +
50 Kg of SP 36 x 1000 Rp = 50 000 Rp +
50 kg of KCl x 1200 Rp = 60 000 Rp
total cost : 145 000 Rp
total cost (2 applications per year) : 290 000 Rp
cost per plant in the field: 30 Rp.
It requires a minimum of 2 rootstock plants for 1 stump : so
Cost for stump : 60 Rp.

Labour and herbicide cost :

For all the nursery : annual cost

Fencing :	170 000 Rp
Weeding :	16 000 Rp
Herbicide	150 000 Rp
Dithane M 45	60 000 Rp
TB for grafts	6 000 Rp
Total cost	402 000 Rp

Cost per stump produced (13 000 stumps) : 30 Rp

Budwood cost

The nursery has its own budwood garden.
If budwood had to be purchased outside the farm, the increase in cost of production will be 143 Rp/stump (1 meter sold at 1 000 Rp with 15 buds and 50 % grafting success so 7 effective buds).
If the farmer buys subsidised DISBUN PSSP budwood (300 Rp/meter) , the increase in cost is then only 43 Rp.

This extra cost explains why few nurseries actually purchase budwood at that price and prefer to 'take" it free of charge from TCSDP budwood gardens. This also explains why so many nurseries probably DO NOT use real clonal budwood in order to avoid such a cost.
It is therefore essential for private nurseries, even small scale ones, to have their own budwood garden. Firstly in order to secure their budwood supply, and secondly to reduce production costs.

Plastic cost

The cost of plastic for grafting is also very high (28 %) and can be reduced by using raffia. The cost will be then 15 Rp/stump rather than 70 Rp with plastic.

Cost of production of polybagged stumps

Stump	250 Rp
Polybag	100 Rp
Labour	50 Rp
total cost of polybag	400 Rp
sale price at farm gate (GT 1)	900 Rp
sale price at farm gate (other clones)	1300 Rp

Gross margin per polybag for GT1 500 Rp
Gross margin per polybag other clones 900 Rp

It is clear that with such margins, sales of clones in polybags are preferred by private nurseries.

It is also clear that from a smallholder development point of view, the recommendation should be that the smallholders purchase stumps and create their own small polybag nursery, in order to reduce the cost of investment in clonal planting material from 900-1300 Rp per purchased polybag to 450 Rp per self produced polybag.

Conclusion on clonal planting material availability in Jambi province

The situation may be summarized as follows :

- There is NO homogenous policy for planting material supply : budwood is free at P2KP2/DISBUN budwood gardens and sold at subsidized prices at PSSP/DISBUN budwood gardens. Stumps are sold at 125 Rp by P2RT, and between 250 and 350 Rp by private nurseries. This situation is very confusing for farmers but at least, sources of planting material do exist.

- The process of budwood purchase is rather long and not straightforward, involving visits to the DISBUN office to order and pay, before actually taking the budwood.

- The sale of subsidized stumps is organised through the Camat and some extensionists (PPL). There is obviously a problem of information and distribution

- The current potential budwood production for the 2 clones among our selection (BPM 1 and BPM 24) is rather small, allowing a maximum of 2 000 hectares to be planted each year by farmers with access to this planting material. Some budwood gardens need a serious programme of clonal purification

- The current budwood garden network does not provide the recommended clones, except for BPM 1 and BPM 24. It therefore necessary to plant new budwood gardens with the selected clones, (in particular PB 260, RRIC 100 and RRIM 600), in addition to the rehabilitation of existing budwood gardens.

In conclusion, budwood from BANDES is totally unusable (the clones have been mixed up). Farmer groups or private nurseries still using these, or using small private budwood gardens derived from BANDES should be provided with new budwood gardens. The quality of planting material is very bad.
The failure of the BANDES programme is due to a lack of preparation and information during establishment, and also a lack of follow up in the long term.
Development of village budwood gardens still has potential in certain circumstances, such as remote or poor areas, if implemented with a participatory approach.

4 Assessment of purchasing power of smallholders regarding rubber planting material

In 1997, ICRAF/SRAP implemented a farming system survey in order to characterise farms in Kabupaten Muara Tebo (A Kelfoun, E Penot, 1997) in 5 villages representative of the area :

- central plains area: village of Seppungur
- piedmont area: Rantau Pandan and Muara Buat
- transmigration area: Sukadamai and Saptamulia.

The sampling method was based on the selection of SRAP farmers (those who have a RAS/Rubber Agroforestry System on-farm trial) and non project farmers, selected on a randomised basis (but with farming as their main activity). The total number of surveyed farmers is 68 as follows:

Table 25. Distribution of farmers in survey

Village	Sepunggur	Muara Buat	Rantau Pandan	Sukadamai	Saptamulia
Location	Central plain	Piedmont	Piedmont	Transmi-gration	Transmi-gration
SRAP Farmers	12	5	7	0	0
Non project Farmers	17	4	6	10	7
Total no. of farmers per village	**29**	**9**	**13**	**10**	**7**

All costs and income calculations correct as of July 1997.

We provide this information in order to assess the ability of average rubber farmers to have sufficient cash flow for investing in new rubber plots, a nursery or a budwood garden and their capacity for potential reimbursement of credit. This sample is representative of farmers' income except for the village of Rantau Pandan where the SRAP farmers (6) are NOT representative : these are local teachers, traders or policemen -who have a rubber plots in addition to their main activity. Therefore, the range of incomes from this particular village is NOT representative of farmers.. However, we present these figures to show that there is also a stratum of local people that are investing in clonal rubber plots and might be considered as an important target. These people could be considered (if supported with the best up-to-date technical information) as potential demonstration plot owners.

ESTIMATION OF THE VALUE OF THE LAND

Table 26 : COST OF 1 HECTARE OF LAND IN 1996

Village	Sepunggur	Muara Buat	Rantau Pandan	Rimbo Bujang Transmigration
Bushland	320 000	120 000		750 000
Jungle rubber	780 000	315 000		900 000
Clonal rubber plantation				10 000 000 credit included

Source : Interviews with local farmers.

We assumed that most of farmers will not to have not to buy land, except those in transmigration areas. However, land is becoming scarce and there is an emerging market for land due to existing potential buyers like transmigrants and the wealthier citizens in the village. Allocation of land for oil palm plantations is also seriously reducing land availability in some villages.

ECONOMIC ANALYSIS OF CROPPING SYSTEMS

NET INCOME PER TYPE OF CROPPING SYSTEM, per year and per ha

Table 27 : Rubber cropping systems

	Rubber system	No. of farmers	Net income (.000 Rp/ha/year)
Sepunggur	*Jungle rubber*	24	**1480**
Muara Buat	*Old Jungle rubber*	6	**1078**
Rantau Pandan	*Old Jungle rubber*	9	**1146**
Sukadamai	*Clonal rubber monoculture*	2	**2552**
Saptamulia	*Clonal rubber monoculture*	7	**3046**

Average data from 68 farmers.

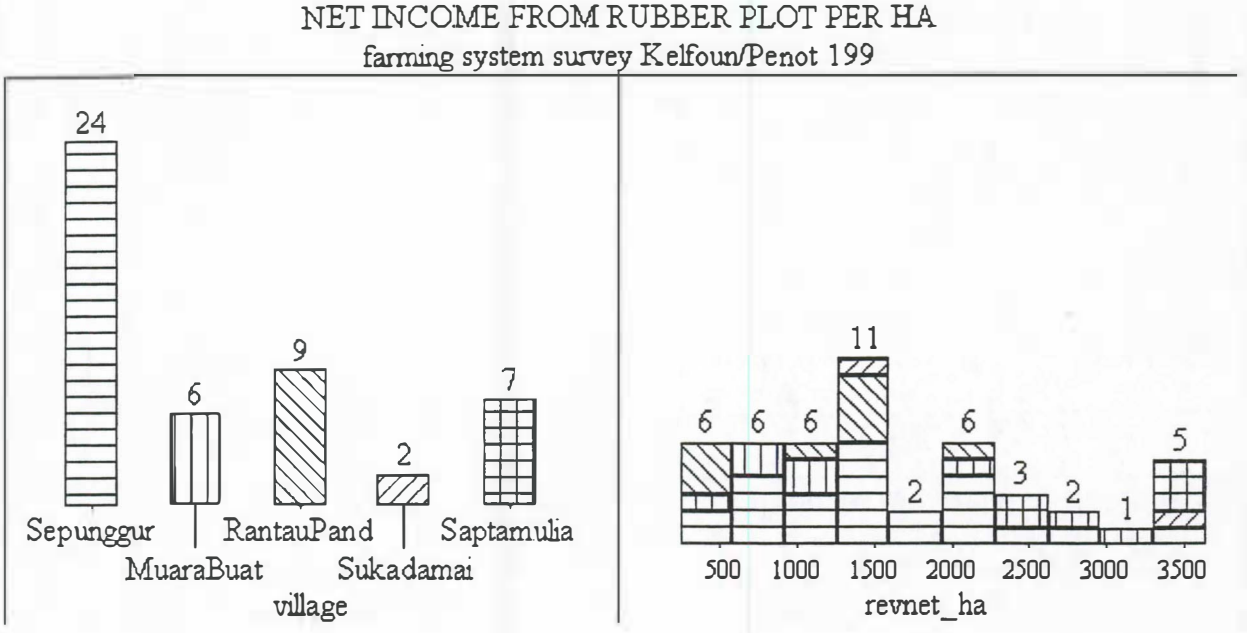
Net average income from rubber plots per hectare and per year

- Jungle rubber : **1 341 000** Rp/ha/year
- *Clonal rubber monoculture* : **2 937 000** Rp/ha/year

These tables show clearly the advantages in terms of net annual income of clonal rubber compared to jungle rubber based on unselected seedlings. Clonal rubber production is that of GT1 clone (average yield 1300-1600 kg/ha/year). Production potential of clones like PB 260 and RRIC 100 are expected to be superior to that of GT 1 (1600-2000 kg/ha/year).

Figure 1. Distribution of net income from rubber plots.

Revnet_ha = net income per hectare
Source : A Kelfoun, E Penot, 1997, SRAP workshop



This last figure shows the distribution of net income (profit) per hectare for rubber : all profits above 1 500 000 Rp are from clonal rubber. Also displayed is distribution by village (number of respondents). Seppungur village can be considered as representative of rubber farmers in the central plain with average/easy access to the main road.

One hectare of rubber in production enables farmers to repay a small amount of credit on a yearly basis, such as 250 000 or 500 000 Rp. Their problem is more a problem of cash flow availability at a particular time (planting) rather than the amount in itself.
Farmers with more than 1 hectare of clonal rubber definitely have the capacity to repay the investment cost of establishment of 1 hectare of clonal rubber (between 500 000 and 1 000 000 Rp).

We consider that the annual target for a farmer in terms of credit and rubber planting should be the establishment of 0.5 ha for a "poor farmer" and 1 ha for a "rich farmer", every 2 years.

Income from annual crops

Table 28 : Sawah/irrigated rice

	Type of seeds	No. of farmers	Net income (.000 Rp/ha/year)
Muara Buat	*Local varieties*	6	**756**
	Improved varieties	1	**1094**
Rantau Pandan	*Local varieties*	1	**345**
	Improved varieties	4	**1126**

Net average income from sawah rice plots per hectare and per year
- local varieties : **697 000** Rp/ha/year
- Improved varieties : **1 120 000** Rp/ha/year

Price of paddy : 1200 Rp/kg

Ladang

Table 29 : Average annual income from local rice varieties (5 farmers)

	No. of farmers	Yield in kg/ha	Net income (.000 Rp/ha/year)
Sepunggur	1	480	346
Muara Buat	2	908	654
Rantau Pandan	1	1080	777
Sukadamai	1	300	216

Net average income from upland rice/ladang plots per hectare and per year

529 000 Rp/ha/year

Income from rice production (sawah or ladang) does not seem to be sufficient to reimburse credit. It is clear anyway that rice is cropped to secure self-sufficiency in rice and not to raise capital for further investment in tree crops.

Cinnamon
Harvested at the 7th year
Table 30

Net average income from a cinnamon plots per hectare
2 000 000 Rp/ha/year

Income from cinnamon might enable a farmer to establish 1 to 2 hectares of clonal rubber.

- **CONCLUSION**

Comparison of various cropping systems income :

Table 31. Comparison of various cropping systems income

Cropping systems	Net income (.000 Rp/ha/year)
Rubber: jungle rubber	1 341
clonal monoculture	2 937
Sawah: local varieties	697
Improved varieties	1 120
Ladang (upland rice)	529
Cinnamon	2 000

LABOUR REQUIREMENT AND RETURN TO LABOUR PER CROPPING SYSTEMS

LABOUR REQUIREMENTS PER CROPPING SYSTEMS in mandays

1 manday is equivalent to 8 hours of work/day.

These data will be used for the calculations of return to labour.

Table 32. Rubber in production : labour requirement in mandays

	Weeding	Tapping	Latex collection	TOTAL
Sepunggur	3	60	9	72
Muara Buat	2	53	9	64
Rantau Pandan	2	69	7	78
Sukadamai	5	43	8	56
Saptamulia	7	38	8	53
Jungle rubber	2	61	8	71
Clonal Monoculture	7	40	8	55

NB These are calculated mandays of 8 hours. Generally, farmers tap their rubber fields from 6am to 11 or 12 midday, leaving another 2 or 3 days of work in the afternoon for ladang or other activities.

Table 33 : Sawah :Annual labour requirement per year , transport not included .

	Type of seeds	Number of farmers	Ploughing	Sowing	Weeding	Harvest	TOTAL
Muara Buat	*Local*	**6**	54	33	45	57	189
	Improved	**1**	80	20	42	40	182
Rantau Pandan	*Local*	**1**	60	30	60	80	230
	Improved	**4**	41	37	71	39	188
Average for Local varieties		**7**	55	33	47	60	195
Average for Improved varieties		**5**	49	34	65	39	187

Table 34 : Ladang : labour requirement in mandays

	Number of farmers	Ploughing	Sowing	Weeding	Harvest	TOTAL
Sepunggur	**1**	24	6	10	12	52
Muara Buat	**2**	8	13	8	29	58
Rantau Pandan	**1**	40	30	40	60	170
Sukadamai	**1**	60	30	30	10	130
Average	**5**	**28**	**19**	**19**	**28**	**94**

Note : these figures are slightly lower than those obtained by P Levang in 1989 (110 to 120 manday/ha).
It shows that labour required for rubber is less than that of annual crops, and provides a more sustainable regular income on an annual basis.

RETURN TO LABOUR for VARIOUS CROPPING SYSTEMS

Table 35 : Rubber

	Rubber system	Number of farmers	Return to labour (.000 Rp/manday)
Sepunggur	*Jungle rubber*	24	**25,3**
Muara Buat	*Old Jungle rubber*	6	**18,8**
Rantau Pandan	*Old Jungle rubber*	9	**16,5**
Sukadamai	*Clonal rubber monoculture Young plantations*	2	**27,4**
Saptamulia	*Clonal rubber monoculture Mature plantation*	7	**61,8**

Average return to labour for various rubber cropping systems :

- Jungle rubber :	**22 300** Rp/manday
- *clonal rubber Monoculture* :	**54 200** Rp/manday

Return to labour for clonal rubber is 2.5 times that of jungle rubber. The main constraint is, in the case of clones, the labour requirement during immature period.

Table 36 : Sawah

	Type of seeds	Number of farmers	Return to labour (.000 Rp/manday)
Muara Buat	*Local varieties*	6	**5,4**
	Improved varieties	1	**6,0**
Rantau Pandan	*Local varieties*	1	**1,5**
	Improved varieties	4	**8,7**

Average return to labour for various sawah cropping systems :
- Local v*arieties* : **4 800** Rp/manday
- Improved v*arieties* : **8 200** Rp/manday

Ladang

8 000 Rp/manday.

It seems clear that tree crops, and in particular rubber, have a far better return to labour for farmers, and this has been the case for many years. Rice is still cropped for food security reasons.

Comparison between different cropping systems in terms of return to labour

Table 37

Cropping Systems		Net income (.000 Rp/manday)
Rubber	jungle rubber	22 300
	Clonal monoculture	54 200
Sawah	local varieties	4 800
	Improved varieties	8 200
Ladang		8 000

The return to labour of the clonal rubber system is far more attractive than that of other cropping systems, and confirms the great interest of farmers in clonal rubber.

ECONOMIC ANALYSIS AT THE FARMING SYSTEM LEVEL

These calculations take into account the average area per cropping system per farm.

Table 38 : RUBBER AREA AND AVERAGE PRODUCTION PER FARM

	Jungle rubber			*Clonal Monoculture*	
	Sepunggur	Muara	Rantau	Sukadamai	Saptamulia
Average area of rubber per farm (ha)	4,02	2,72	5,00	1,72	4,19
Productive area per farm (ha)	2,76	1,47	1,62	0,31	2,54
% of total area	*68,6 %*	*54,0 %*	*32,4 %*	*18,0 %*	*60,6 %*
Average Production of Slabs/cup-lump (kg/ha/year)	1341	1144	1279	2960	3393

Table 39 : RUBBER YIELDS

	Sepung gur	Muara Buat	Rantau Pandan	Sukada mai	Saptamu lia	**Local**	**Clones**
Rubber yield (kg/ha/year)	670	640	572	1480	1696	**648**	**1649**

N.B. A slab has 40 to 60 % DRC with an average of 50 % DRC (*Dry Rubber Content*).

Average price of rubber in July 1997 in Sepunggur was 1150 Rp/kg of slab , so 2300 Rp/kg of dry rubber 100 % DRC. In the Transmigration area (Rimbo Bujang) the price was 950 Rp/kg of slab , so 1900 Rp/kg of dry rubber 100 % DRC

The current price in March 1998 is 4 000 Rp/kg of dry rubber 100 % DRC .

NET INCOMES PER FARM PER VILLAGE

RUBBER

Table 40 : Net income from rubber

	Sepunggur	Muara	Rantau	Sukadam	Saptamulia
Average Production per farm (kg/year)	3651	2140	2206	2920	8824
Value of the production (.000 Rp/year)	3459	2033	2041	2392	8383
Net income from rubber[1] (.000 Rp/year)	3411	2015	2003	2283	7951

SAWAH

Table 41 : Rice yield

	Type of seeds	Number of farmers	Yield In kg/ha/year
Muara Buat	*Local varieties*	6	**1118**
	Improved varieties	1	**1800**
Rantau Pandan	*Local varieties*	1	**480**
	Improved varieties	4	**1565**

Average yields of sawah, :
- Local *Varieties* : **1027** kg/ha/yr
- Improved varieties : **1612** kg/ha/yr

[1] *NB : Income is calculated as production value minus inputs costs (labour not included).*

Table 42 : Income from sawah per farm PER VILLAGE

	Sepunggur	Muara Buat	Rantau Pandan	Sukadamai	Saptamulia
Average production of paddy in kg/year	0	1085	1132	0	0
Value of the production (.000 Rp/year)	0	782	815	0	0
Net income (.000 Rp/an)	0	730	803	0	0

Only some villages are operating sawah plots. Income from sawah, even at the farm level, does not seem sufficient for credit reimbursement.

LADANG

Average Yield	***735 kg/ha/year***
Average production of paddy per farm	***938 kg/year***
Net income per farm	***675 000 Rp/year***

NB ; data from 5 farmers only.

Current ladang income cannot be considered as a reliable source of cash for credit reimbursement.

AVERAGE FARM INCOME from farming activities

Table 43. Average farm income from farming activities

	Sepunggur	Muara Buat	Rantau Pandan	Sukadamai	Saptamulia
Farm net income (.000 Rp/year) from farming activities	**3 321**	**2 285**	**1 704**	**688**	**8 271**

AVERAGE FARM INCOME from off-farm activities :

from rubber share- tapping : system bagi tiga (2/3 for the tapper)

Table 44. Income from share tapping

	Value of the production (.000 Rp/ha/year)	Inputs costs (.000 Rp/ha/year)	*Share to the tapper*	Net income for the tapper	Net income for the owner
Sepunggur	1496	16	*2/3*	**996**	**483**
Muara Buat	932	8	*2/3*	**621**	**303**
Rantau	1164	18	*2/3*	**775**	**370**
Rimbo Bujang (clonal plantation)	3099	162	*1/3*	**1023**	**1904**

Average income from off-farm activities

Table 45. Average income from off farm activities

	Sepunggur	Muara Buat	Rantau Pandan	Sukadamai	Saptamulia
Number of farmers with non-farming source of income	10/29	5/9	12/13	9/10	3/7
Type of work	Timber Trade Fishing Warung* Civil servant	Timber Trade Fishing Civil servant	Trade Civil servant(9 out of 12)	Labourer	Trade Warung Nursery
Non farming net income per farm (.000 Rp)	**2712**	**4224**	**5369**	**1101**	**3640**

* Warung- small shop/food stall

The village of Rantau Pandan with 9 out 12 "farmers" being civil servants is not considered representative. Off farm activities are relatively important and can be considered as a source for credit reimbursement.

TOTAL INCOME OF FARMS

Total farm income include incomes from agricultural activities (Type A) as well as incomes from off-farm activities (Type B).

Table 46. Total farm income

	Type	No. of farms	Incomes from Agriculture (.000 Rp/year)	*% of total*	Income from off-farm activities (.000 Rp/year)	*% of total*	Total income (.000 Rp/year)
Sepunggur	*A*	19	3 546	*100 %*	0		3 546
	B	10	2 938	*52,0 %*	2712	*48,0 %*	5 650
Muara Buat	*A*	4	3 184	*100 %*	0		3 184
	B	5	1 745	*29,2 %*	4224	*70,8 %*	5 969
Rantau Pandan	*A*	1	979	*100 %*	0		979
	B	12	1 764	*24,7 %*	5369	*75,3 %*	7 133
Sukadamai	*A*	1	1 660	*100 %*	0		1 660
	B	9	366	*24,9 %*	1101	*75,1 %*	1 467
Saptamulia	*A*	4	6 954	*100 %*	0		6 954
	B	3	10 026	*73,4 %*	3640	*26,6 %*	13 666

Total average farm income per village

Table 47

	Sepunggur	Muara Buat	Rantau Pandan	Sukadamai	Saptamulia
Total average farm income (.000 Rp/an)	**4325**	**4925**	6660 *non representa-tive sample*	**1679 young plantation**	**9831 mature plantation**

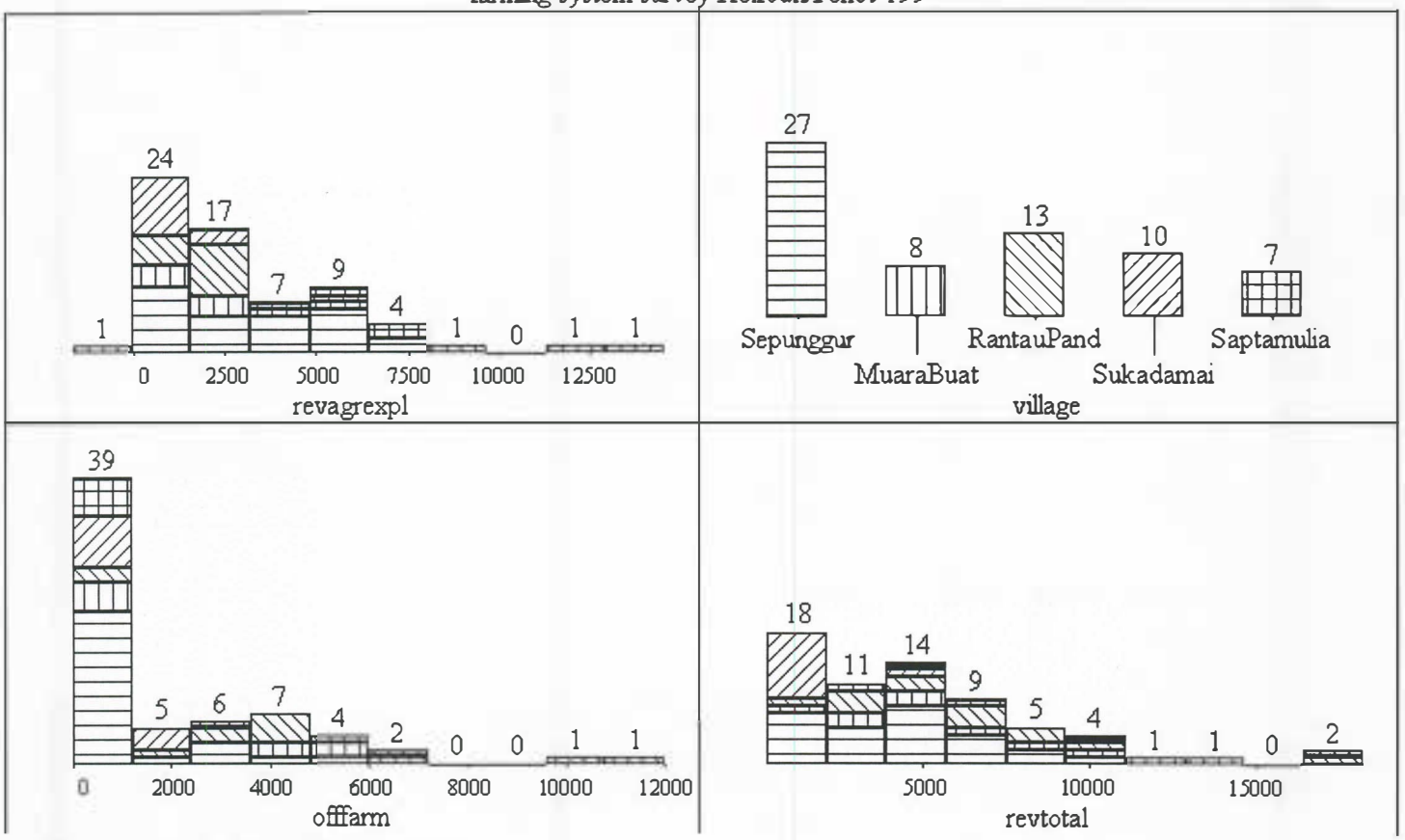
These figures show that capital might not be the first problem for rubber farmers, at least in this representative sample of 68 farmers in Kabupaten Bungo Tebo, even for farmers still relying on jungle rubber. Cash availability at a given time, e.g. for establishment of a polybag nursery, fence construction, planting and fertilisation might be the real constraint.

The distribution of farms (see Figure 2) according to income level shows that these average figures are relatively representative of the "average farmer" in Jambi province (the income data are well distributed around 4 to 5 million Rp/year).

Revtotal = total farm income

Revagrexpl = income from farming activity

INCOME DISTRIBUTION IN JAMBI PROVINCE
farming system survey Kelfoun/Penot 199



Offarm = income from off farm activity

Source : A Kelfoun, E Penot, 1997
, SRAP workshop.

Conclusion on farmers'incomes and investment in rubber plantation.

The analysis of incomes and the source of incomes shows that capital is not the main constraints for farmers to adopt clones in monoculture or in RAS systems (Rubber Agroforestry Systems). Rubber production, even from jungle rubber, enables farmers to capitalize and invest in clonal rubber systems at least for a small area such as 0.5 ha every 2 years. The main constraints are in fact the lack of up-to-date technical information for farmers and private nurseries owners as well as the low availability of clonal planting material.

5. Proposals

General scheme

A programme of budwood production (budwood gardens) at the province level should be organised on the following basis, with 2 main activities :

- Rehabilitation of existing budwood gardens, at least for the clones that have been selected i.e. TCSDP, APBD and PSSP budwood gardens with the clones BPM 1 and BPM 24. The budwood gardens should be maintained, re-purified if possible using electrophoresis technique, or at least visually checked again by technicians from Sembawa (as there is still obviously some mix up, 10 to 20 % perhaps, within these 2 clones). The other clones should be removed except GT1.

- Plantation of new budwood gardens including the 3 other clones that are not currently available in the province : PB 260, RRIC 100 and RRIM 600 (BPM 1 is already available). This can be done with the private sector (with a small credit scheme) or at project level in remote areas.

The APBD Pijoan budwood garden : this is obviously mixed up and unusable. It seems too risky to be used again. No certification should be given to the stumps using budwood from this budwood garden.

The case of BANDES budwood gardens can be treated as follows : if the budwood (a mixture of 2 or 3 clones) is to be used for plantations by farmers, we can assume that access to a mixture of clones is better than nothing. If the budwood is going to be used by private nurseries for stump production, there is NO scope for any certification and this should be avoided at all costs. As in most cases, there is generally only one private nursery (if any) that still profits from the budwood garden, it seems that it would be better to remove the BANDES budwood gardens that are still used by private nurseries.

Organisation of the clonal rubber commodity system :

TARGETS/clients
3 main categories of producers should be considered :

- 1 - private nurseries
  - operated by farmers
  - operated by TCSDP/DISBUN staff

- 2 - community managed village budwood garden

- 3 - governmental agencies budwood gardens
  - TCSDP
  - DISBUN

Specific action can be taken for each target group (see later).

MULTIPLICATION SHEME
In any case, the system of multiplication should follow the same scheme :

- clear identification of the source of stumps for the establishment of new budwood gardens. All planting material to be used in a new budwood garden should come from a COLLECTION BUDWOOD GARDEN.

The sheme is the following :
Collection BUDWOOD GARDEN ----------> Multiplication BUDWOOD GARDEN-----
>Satellite BUDWOOD GARDEN
level 1

level 2
- Rehabilitation of existing budwood gardens
- Creation of new BUDWOOD GARDEN

production potential is the following :

Table 48. Potential hectarage of new budwood gardens

Clones	RRIC 100	PB 260	BPM 24	BPM 1	RRIM 600
No. of plants	6 500	7 200	7 450	14 450	3 100
No. of potential stumps to be produced per year	97 500	108 000	111 750	216 750	46 500
No. of ha of budwood garden, potentially	12.2	13.5	14	27	5.8

(Assuming that a budwood garden has 8 000 plants per ha).

Sembawa seems to be in a favourable position to supply JRDP with the required clonal stumps for satellite budwood garden establishment in the Jambi province. Another source might be the GOODYEAR plantation located in North Sumatra which has a very reliable budwood garden.

It might also be possible to establish a second Multiplication budwood gardens /level 1 (for core budwood provision and supply) in the Jambi province, preferably close to Muara Bulian in order to supply the 3 Kabupaten easily. If that solution is chosen, this budwood garden should also be strictly operated and also entirely checked using the electrophoresis technique (100% of the plants). These budwood gardens might be very useful in order to limit transport costs from Sembawa, but on the condition that they should be very well implemented and managed.

Satellite budwood gardens /Level 2 should be established with planting material coming only from the Multiplication/Level 1 budwood garden with a certificate of provenance and high quality of planting, observing a fixed protocol for all satellite budwood gardens.

BUDWOOD GARDEN PROTOCOL for establishment

The protocol should be the following :

- no mix-up of clone,
- 2 clones only per private nursery,
- clear separation of blocks between clones,
- correct labelling of blocks and good maintenance,
- planting under the supervision and the responsibility of BIPP, TCSDP or DISBUN staff.
- - Final checking using the electrophoresis technique, on a sample of 10 % of the total plants.
- no seedlings trees allowed in the budwood gardens.

With such system, we ensure the guarantee of origin of the planting material at all level through a right channeling and a permanent control with electrophoresis technique and the continuity of the quality of the system if the system is growing up (extension of satellite budwood gardens) .

Stump production

Other technical issues are the age and size of stumps.

The best seeds for rootstock plants are seeds from GT1, LCB 1320 and AVROS 2037. As it is almost impossible now to collect seeds from the last two, GT1 illegitimate seeds are considered as the best rootstock planting material.

Seed season in Jambi is in February/March. Grafting season is between June and October, before the heavy rains of November. This leads to only 6 to 7 months at most for stumps to be grafted. The recommended method for field planting is the use of polybagged plants with 1 whorl of leaves, which requires another 3 months growth after grafting. In this case, planting may occur in January/February, a little too late in the rainy season to ensure a good planting, and there is a higher risk of plant mortality due to the dry season.

The current system is based on the use of GT 1 seeds collected in North Sumatra where the seed season is in November, allowing early grafting in July and planting in October. Early planting of polybagged stumps in October is highly recommended. In that case, stumps put in polybags are 10 to 12 months old.

There are currently private nurseries organising GT 1 seed supplies from North Sumatra for their own use, as well as for sales to local farmers (seeds are bought for Rp 7.5/seed, transport to Jambi included, and sold at 10 to 12 Rp to consumers).

Another alternative is to continue the use of GT1 seeds from Jambi, collected in March/year 1, but grafted in September and maintained in the rootstock nursery until July/year 2 in order to obtain polybagged stumps ready to plant in October/year 2. In that case, stumps put in polybags are 18 months old and grow faster.
This alternative will produce better quality stumps, but requires both technical information for nursery owners as well as more time in the nurseries that might lead to a small increase in price (as the return on capital investment is delayed from 12 months to 18 months).

ASSISTANCE TO PRIVATE NURSERIES

The suggested actions to be undertaken for the 3 main target groups are the following.

- 1 - Assistance to private nurseries

2 types of private nurseries can be considered :

- nurseries operated by farmers :

Theses nurseries have been generally established by progressive farmers (among them many transmigrants) who want to take advantage of the emerging market for clonal rubber planting material. This market is sustained by former project farmers (NES and TCSDP in particular) and civil servants or notabilities from cities. Most of them have a rather small production, that can be considered as an additional source of income beside other farming activities (generally rubber). Some are, or plan to specialise in nursery activity and their production is higher and constitutes their main farming activity.
In the first case, small disseminated budwood gardens will be generally sufficient, but we know that the BANDES budwood gardens that still exist cannot be used for budwood supply as they are all mixed up. For private nurseries established close to an existing rehabilitated budwood garden, such as TCSDP, APBD or PSSP, it wouldn't be a problem (provided these budwood gardens can be rehabilitated, checked and supplied with the new selected clones). We also suggest that a maximum of 2 clones should be provided to small nurseries, in order to limit risks of mixing. Of course, a balance between nurseries should be found in order to obtain a relatively equal distribution of stumps for each clone (4).
In the case where there are no existing budwood gardens, new ones should be created in area where private nurseries have been concentrated. These new budwood gardens could be established and managed under the supervision of the local association of private nurseries, or directly by the biggest private nurseries. The operator for establishment could be the associations or DISBUN on a contractual basis, provided they follow the budwood establishment protocol.

It seems essential therefore to support the creation of local associations of private nurseries as a link between users (farmers that purchase planting material) and JRDP and associated institutions.
In other words, we define the concept of "creation of an association" by providing information to private nursery owners and allow the development of an association according to an endogenous process.

For big nurseries : it seems essential to help them to establish their own budwood gardens, with certified budwood from collection budwood gardens and with a chart based on the protocol formally presented for all satellite budwood gardens.
It seems essential to provide technical up-to-date information and training to these private nursery operators in order to maintain a high level of quality in production and to ensure a correct application of the "certification process".

- 2 nurseries operated by TCSDP/DISBUN staff

The same conditions should be applied to private nurseries developed by TCSDP and DISBUN staff but as these particular staff are generally well trained in technical matters, they should definitely be considered as priority for assistance, in particular for budwood supply. Their ability to produce good planting material and their technical knowledge should be enhanced.

- 3 selection of nursery owners

The programme should be targeted to owners who are prepared to implement the quality control process. Small credit provision for budwood garden establishment or cash flow assistance should be linked with this quality control process. Small loans can be recovered in one year as the return to capital with planting material should be around 1 year for 12 month stump production or 1.5 years for 18 month stump production.

Quality control supervision and recommendations process for private nursery

In all cases, Quality control supervision and recommendations process for private nursery should be based on the 2 following criterias :

- the respect of satellite budwood garden establishment protocol

- the identification of a maximum production of stumps per clones according to budwood garden capacity (big nurseries) or supply (small nurseries).
A maximum production capacity (number of stumps) will be calculated according to the budwood garden production or to the budwood supplied to the nursery owner.
The production is calculated by taking into account the budwood meterage supplied, or bought, to nursery owners, or on the budwood meterage production, with a grating success rate of 50 %. Basically, 1 plant in a budwood garden can produce the following final amount of stumps :

	YEAR1	YEAR 2	YEAR 3 and later
Maximum production From 1 plant	5 stumps	10 stumps	15 stumps

4 Other assistance in order to increase planting material supply to remote areas

One of the main constraints for remote farmers is the cost and time required for transportation of planting material to their fields, in particular if there are no private nurseries in their village. One idea could be to support the distribution of stumps through village traders. This could be achieved on one condition: if farmers have enough information on clones and the demand is clearly quality oriented.

5 Assistance to BIPP

The current technical assistance through BIPP is composed of 67 PPL in the 3 Kabupaten. BIPP staff should be trained and provided with all technical up-to-date information on clones, budwood gardens and nursery management as well as quality control procedures (certification).

The necessary technical recommendations and information may be under various types of material: books, leaflets, etc. The role of the Research Centre of Sembawa should be emphasised and supported in the preparation and diffusion of these materials.

Conclusion

On budwood garden availability in the Jambi province :

Emphasis should be put on the use of existing rehabilitated budwood gardens.
In case there is no existing budwood gardens, new ones should be created in area where private nurseries have been concentrated. These new Budwood gardens could be established and managed under the supervision of the local association of private nurseries or directly by the biggest private nurseries. The operator for establishment can be the associations or the DISBUN on a contractual basis, provided they follow the budwood establishment protocol

For big nurseries : it seems essential to help them to establish their own budwood garden ; with certified budwood from collection budwood gardens and with a chart based on the protocol formerly presented for all satellite budwood gardens.
It seems essential to provide technical up-to-date information and training to these private nurseries operators in order to maintain a high level of quality in production and to ensure a correct application of the "certification process".

Quality control of nurseries

In all cases, Quality control supervision and recommendations process for private nursery should be based on the 2 following criterias :

- the respect of satellite budwood garden establishment protocol
- the identification of a maximum production of stumps per clones according to budwood garden capacity (big nurseries) or supply (small nurseries).

Small credit for budwood establishment or cash flow assistance should be linked with this quality control process

Technical Information for farmers

The required technical recommendations and information may be under various type of supports : books, leaflets..... The role of the Research Centre of Sembawa should be emphasized and supported in the preparation and diffusion of these supports. BIPP should train their extensionists with this new training material or information kit, in particular on cropping systems (monoculture and Rubber Agroforestry Systems) and on clones characteristics.

Selected bibliography

1. BUDIMAN, AFS., PENOT E., DE FORESTA, H., SUYANTO & TOMICH, T. (1994) Wanatani karet terpadu untuk masa depan karet rakyat Indonesia (Rubber Agroforestry Systems as alternatives for smallholders in Indonesia). Presented at the National Rubber Conference. Indonesian Rubber Research Institute. Medan, November 1994.

2. BARLOW C. 1993. *Towards a planting material policy for Indonesia rubber smallholdings: lessons from past projects*. Unpublished paper.

3. COURBET P, PENOT E & Ir ILAHANG. 1997. *Farming system characterisation and innovations adoption process in West-Kalimantan* Paper presented at the SRAP workshop on R.A.S. (Rubber Agroforestry Systems), ICRAF, 29-30th September 1997. Bogor, Indonesia

4. DE FORESTA, H., (1992) Botany contribution to the understanding of smallholder rubber plantations in Indonesia : an example from South Sumatra. Symposium Sumatra Lingkungan dan Pembangunan. Bogor, Indonesia : BIOTROP.

5. DGE. 1996. *Statistik Karet*. Jakarta, Indonesia: Ministry of Agriculture.

6. DJIKMAN J. 1951. *30 years of Rubber Research*. University of Miami, Press, USA

7. GOUYON, A., PENOT, E. (1995) Agroforest et plantations clonales : des choix pour l'avenir. Presented at the CIRAD-MES Seminar, September 1995. Montpellier, France.

8. GOUYON A. 1991. Rubber planting material survey in the Jambi province. GAPKINDO. Unpublished.

9. GOUYON, A. (1995) Paysannerie et heveaculture : dans les plaines orientales de Sumatra : quel avenir pour les systemes agroforestiers?. These INA-PG, Paris.

10. KELFOUN A, PENOT E & KOMARDIWAN I. *Farming system characterisation and innovations adoption process in Jambi* Paper presented at the SRAP workshop on R.A.S. (Rubber Agroforestry Systems), ICRAF, 29-30th September 1997. Bogor, Indonesia

11. PENOT, E. (1995) Taking the jungle out of rubber. Improving rubber in Indonesian agroforestry systems. In Agroforestry Today, July-December 1995.

12. PENOT, E. (1996) Sustainability through productivity improvement of Indonesian rubber based agroforestry systems. Paper presented at the 14th International Symposium on Sustainable Farming Systems. Colombo, Sri Lanka, November 1996.

13. PENOT E. *Introduction to SRAP methodology and concepts : summary of the preliminary results*. Paper presented at the SRAP workshop on R.A.S. (Rubber Agroforestry Systems), ICRAF, 29-30th September 1997. Bogor, Indonesia.

14. TOMICH T, 1992.*Smallholder Rubber development in Indonesia*. In Reforming economic systems in developing countries, ed by D.H.Perkins and M Roemer. Harvard University.

15. SHUELLER W, PENOT E, Ir SUNARYO. *1997. Rubber Improved Genetic Planting Material (IGPM) availability and use by smallholders in West-Kalimantan Province. Paper* presented at "ICRAF/SRAP workshop on R.A.S. (Rubber Agroforestry Systems)", ICRAF, 29-30 September 1997. Bogor, Indonesia.

16. WIBAWA G. *Annual report "Projet sur les cultures intercalaires avec l'hévéa"*. 1994, 1995 Sembawa, Indonesia.

ANNEXES

- 1 Rubber planting material types.

- 2 Presentation of the CIRAD Electrophoresis technique for clonal rubber identification

- 3 Visual checking of clonal purity by Sembawa for PSSP budwood gardens : main results.

- 4 BANDES program survey : main results

- 5 Private nurseries survey : main results.

- 6 Preliminary survey of Jambi province in 1997, presented at SRAP workshop, September 1997.

- 8 Clones characteristics

ANNEX 1

Rubber planting material types

1. Introduction

Various types of planting material for rubber are available depending on the mode of propagation and selection. Unselected seedlings (USS) are rubber stumps planted directly using Unselected seeds collected from jungle rubber. A clone is a budded stump resulting from vegetative multiplication of one selected individual tree. Clone production requires infrastructure such as budwood gardens and rootstock nurseries as well as technical skill for grafting. Clonal purity is a major issue in clonal rubber development. An illegitimate clonal seedling (ICS) is rubber planted from seeds obtained from free natural pollination of a monoclonal plot. A polyclonal seedling (PCS) is obtained from seeds from a polyclonal plot. A mother tree is a particularly high yielding tree from which clonal seedlings are collected and selected as mother tree seedlings. Some mother trees, known as primary mother trees, became primary clones with vegetative multiplication (such as GT 1) as early as 1923. Secondary clones are obtained from forced pollination of clones or secondary mother trees.

2 The constraints of using improved planting material : the trade-off between labour requirement and productivity.

Jungle rubber is a very extensive system with almost no weeding being practised. Unselected rubber seedlings are competing with the vegetation re-growth (secondary forest, *Imperata*....). To overcome the competition constraints, farmers use unselected seedlings with a good growth potential at a high planting density: 600 to 1000 trees/ha (sometimes up to 2 000) with no weeding at all. Traditionally, a selective weeding is done before opening the rubber trees for tapping, in order to select the interesting trees of the "belukar" (secondary forest re-growth) and to make paths between trees for tapping. Recently, farmers adopted a new weeding system with one weeding per year in the row only, in order to reduce the immature period to 5/6 years. Tapping is quite destructive (very low bark regeneration) leading to a situation of continual planting of new plots as long as land is available (this is still the case in some provinces such as Riau and Jambi in Sumatra and West and Central Kalimantan in Borneo). The farmers were not so concerned with rubber yield as jungle rubber plots were established at no cost in a sufficient quantity. They generally adapted daily harvest to immediate cash needs, and also used tappers paid on various share cropping arrangements such as bagi-dua (50 % of the harvest for the tapper), bagi-tiga (66 %)...according to rubber and labour prices and labour availability. The continuous flow of spontaneous Javanese transmigrants creates a labour market supply. This system is very flexible. Yields are generally between 350 and 700 kg/ha (average around 500 kg/ha) comparable to that of estates in the 1920's (using the same unselected seedlings but with a higher cost of maintenance). Replanting was initially not a problem as land was available for continuous extension when a jungle rubber plot came to the end of its productive life. Planting rubber is also still a land acquisition process. In fact, initially, rubber harvesting could have been considered as latex collection from a man-made agroforest rather than a real cash crop exploitation.

As land became scarce, population pressure and a high demand for better productivity created the need to improve the system. The main component of this increase in productivity is the use of improved planting material. The passage from a continual extension of jungle rubber to a replanting policy implies a change in farmers' behaviour through a process of intensification and adoption of new strategies concerning labour use and input investments.

3 Type of improved planting material

Improved planting material may be divided in two main groups: the selected seedlings and the clones. Table 1 displays the characteristics of each type of planting material. To summarize : clones have the highest production potential and some very good secondary characteristics (such as resistance to diseases) but are more expensive, require more weeding and attention, a relatively high technical skill and a framework of budwood gardens and nurseries to supply farmers with budded stumps. Seedlings have the reputation of being more adapted to agroforestry conditions with good growth, easy planting using seeds, and a low to medium cost according to the type of seedlings. However seedlings are very heterogeneous, leading to poor tapping management, and yields are low to medium. Recent experimentation on Rubber Agroforestry systems in Jambi and West Kalimantan (SRAP/ICRAF/CIRAD, G Wibawa and E Penot, 1997) suggests that in similar agroforestry conditions, the selected clones grow as well as seedlings when clonal stumps in polybags are used.
We present in the following paragraphs the characteristics of 3 different types of planting material : unselected seedlings, polyclonal seedlings and clones.

A summary of these characteristics is presented in Table 1.

TABLE 1 : Main characteristics of different types of rubber planting material

planting material	ADVANTAGES	DISADVANTAGES
UNSELECTED SEEDLINGS USS	good growth, low cost relatively good adaptability to local conditions, good availability	very low productivity : 350 to 500 kg/ha, heterogeneity in production and resistance to diseases (seedling population).
Mother tree seedlings MTS	good growth medium cost (selection) relatively good adaptability to local conditions no longer available	medium to high productivity (according to level of selection): 700 to 1500 kg/ha, heterogeneity (seedling population)
clonal seedlings ICS	good growth, low cost relatively good adaptability to local conditions good availability for ICS from current clones	low productivity : 500 to 700 kg/ha, heterogeneity (seedling population)
polyclonal seedlings PCS	good growth medium cost (BLIG), (according to level of thinning). relatively good adaptability to local conditions	medium productivity : 1000 to 1500 kg/ha no specific leaf diseases resistance. heterogeneity low availability (from LONSUM only), requires high level of thinning as expensive as clones if well thinned (high selection
CLONES (typology of clones)	slow to very good growth medium to high productivity : 1500-2000 kg/ha homogeneity resistance or susceptibility to various diseases (clonal typology) labour saving for tapping possible sale of rubber wood as valuable timber.	requires grafting clonal purity should be maintained requires a minimum level of weeding. necessary to select clones suited to the local environment. more susceptible to diseases if monoclonal plantation (more risks in small size plantations) expensive if not produced by smallholders themselves

The unselected seedlings (USS)

The first estate plantings in the 1910's and 20's were made with unselected seeds imported from Ceylon and Malaya. Huge quantities were imported to meet the high demand from estates. Originally, all this planting material was derived from a very small stock of plants. 2800 seeds were planted at Kew Gardens in 1876 from the Wickham collection (note), from which only 28 trees survived in Singapore . In 1883 the first 33 trees were introduced to Penang (Malaya) and then to Sumatra and Borneo in 1908 (Djikman, 1953). Cramer began to selection from the best trees among these first 33 introduced trees. This Wickham collection has always given the best yielding trees, even after further tree collection from Brazil[1]. For Instance the "Brazilian type" Hevea gave a yield of 200-250 kg/ha compared to 500-600 kg/ha for the "Ceylon type" (Fallon, 1927, cited by Djikman)

In 1910, yields of seedlings were around 350 kg/ha (b). In 1928, the average observed yield was 1 kg/tree/year leading to 350-500 kg/ha depending on the planting density of tappable trees (c). Then seeds from the first existing plantations in North Sumatra and West-Java (as well as Borneo) were disseminated for new plantations to match the demand boom in the 1920's. Estates and Research stations quickly began to practice selection to improve rubber productivity through two approaches: the release of seeds selected from identified high yielding mother trees, and budding (clones). Therefore, a certain number of seeds used both by estates and smallholder were a mixture of real unselected seeds (identical to the original ones from Ceylon) and clonal seedlings from estates. The current yield of unselected seedlings is around 500 kg/ha. This increase in production, compared to the original 350 kg/ha, may be explained partly by better cultural practices, the increase in number of planted trees/ha (from 350/400 to 500/550) and by the greater proportion of clonal seedlings than in the original population. In 1985, most of the seeds used by farmers in North Sumatra for replanting their jungle rubber are probably coming from PTP (government estates) or private estates, and are generally GT1 seedlings.

So far, we do not know what the exact composition of the current "unselected" seedling population is, but this population clearly includes some selected genotypes that have been incorporated. This may explain also the variability observed in jungle rubber (between 350 and 700 kg/ha). 17 to 37 % of replantings have been made with clonal seedlings (A Gouyon, 1995) according to farmers' level of income (in South Sumatra province, 1990).

The main characteristic of unselected seedlings is the high heterogeneity of trees in terms of production and disease resistance, which is common to all seedlings when compared with clones. Extensive surveys in the 1930's (Djikman) showed that 70 % of the production is given by only 30 % of the trees. Tapping labour and other potential costs (fertilisation, weeding) are far less cost effective for this other 70 % of the trees.

[1] As the IRRDB 1973 collection, the Scholtés collection.....

Heterogeneity in growth, production and susceptibility to diseases is a main features of all non-clonal planting material. The following table shows the expected variability of various type of planting material

Table 2. Evolution of different types of rubber planting material; their performance and cost of establishment per hectare

Year of availability and planting at commercial scale	YIELD/HA IN KG	Remarks
1910	325	unselected seedlings
1920	450	selected seedlings (thinning)
1926	725/775	mother tree seedlings and better cultural practices
1930	1350-1400	first generation of clones TJIR 1 type
1950-60	1500-1700	second generation of clones (PR 107 type)
1980	1700-2000	third generation of clones (PB 260 type)

Source : Dijkman, 1951, Penot, 1993.

The selected seedlings

The first stage in selection of improved rubber varieties is the identification of the best yielding mother trees from which seeds were collected. We know that these seeds have only partly the performance of their parents, but at least are better than local seedlings.
It is not possible to have a prior assessment of the performances of clonal seedlings in relation to their parents. A comparison trial is the only tool to assess clonal seedling performance. Clonal seedling families are related to their parents, which could be: a unique mother tree, a monoclonal garden (clonal seedlings/CS), or a polyclonal garden (polyclonal seedlings/PCS).

Mother tree monoclonal seedling families had the following production :

Table 3. Mother tree monoclonal seedling production

THE USE OF IMPROVED PLANTING MATERIAL	Yield in kg/ha	Date
Unselected seedlings North Sumatra	496	< 1917
first mother trees seedlings	639 (+29 %)	1917-1918

High class selected mother trees seedlings	704 (+ 42 %)	1919-1922

After Maas, 1948, cited by Djikman (survey for IRRC, 1933).

Generally, the increase in production of these mother tree seedlings was between 29 to 42 % above that of USS, depending on selection level. As a mother tree has a very low seed production, large scale planting cannot be expected from this type of planting material.

The clonal seedlings

These seedlings are obtained through the collect of existing clonal plantation seeds. Dijkman assessed that by the 1950's, most of the farmers in North Sumatra in fact used clonal seedlings collected from estates, as many of the workers established their own plantations in the surrounding areas. This is probably true for that particular province but not for other provinces where estates, and therefore sources of clonal seedlings were scarce. Farmers, thus, have to rely on seeds collected in existing jungle rubber. It is however clear that after a century of rubber seed dissemination all over Sumatra and Kalimantan, the current population of local seedlings is partly based on clonal seeds.

We have no clear data on performance of clones planted by smallholders. The only indication is that the yield of smallholders is higher in North Sumatra than in the other provinces as suggested by DGE statistics (DGE, 1996). But farmers have also planted a lot of clonal plantations in that province, so from current statistics it is not possible to distinguish yields of clonal seedling plantations, from jungle rubber or from clonal plantations..
Studies have been made to compare clones and the performance of their related clonal seedlings. One has to keep in mind that all these trials and comparison made in the 1930's and 40's were based on the first or second, generation of clones, which generally have relatively poor yields (around 1 000 to 1 500 kg/ha/year) as shown in Table 4 (average figures for Malaysia in the 1930's) and Figure 1 (In Java in the 1930's).

Table 4

YIELD COMPARISON BETWEEN CLONES AND SEEDLINGS IN MALAYSIA

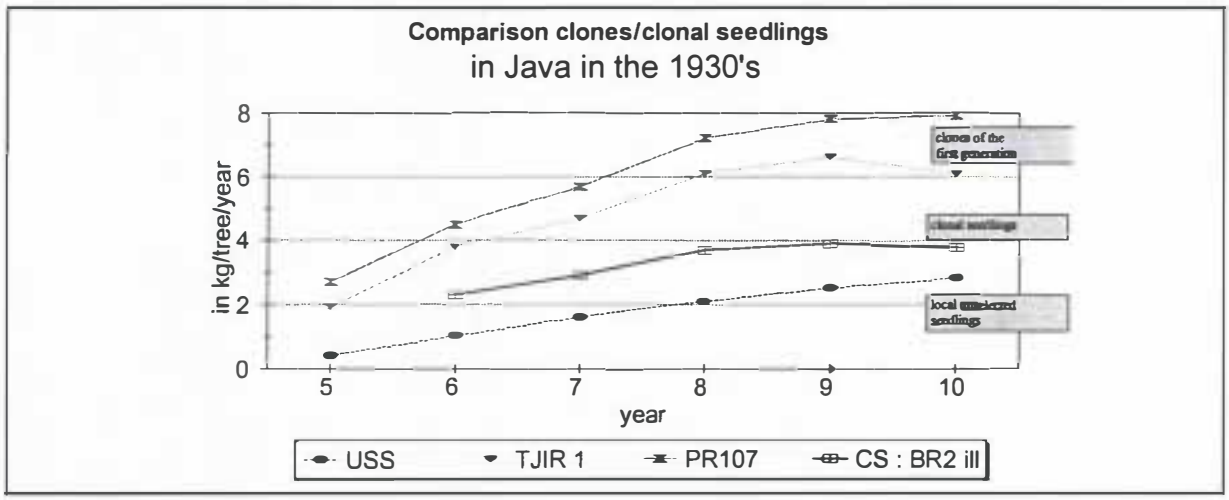
In inland estates trials ***MEAN YIELD OVER 5 YEARS***

TYPE OF IMPROVED PLANTING MATERIAL	Inland ESTATES	Coastal ESTATES
CLONES	1414	1220
CLONAL SEEDLINGS	1132	954
in % of clones	**80%**	**78%**

Source : H M Burkill,1958

Tapping system : D/2

Figure 1 :

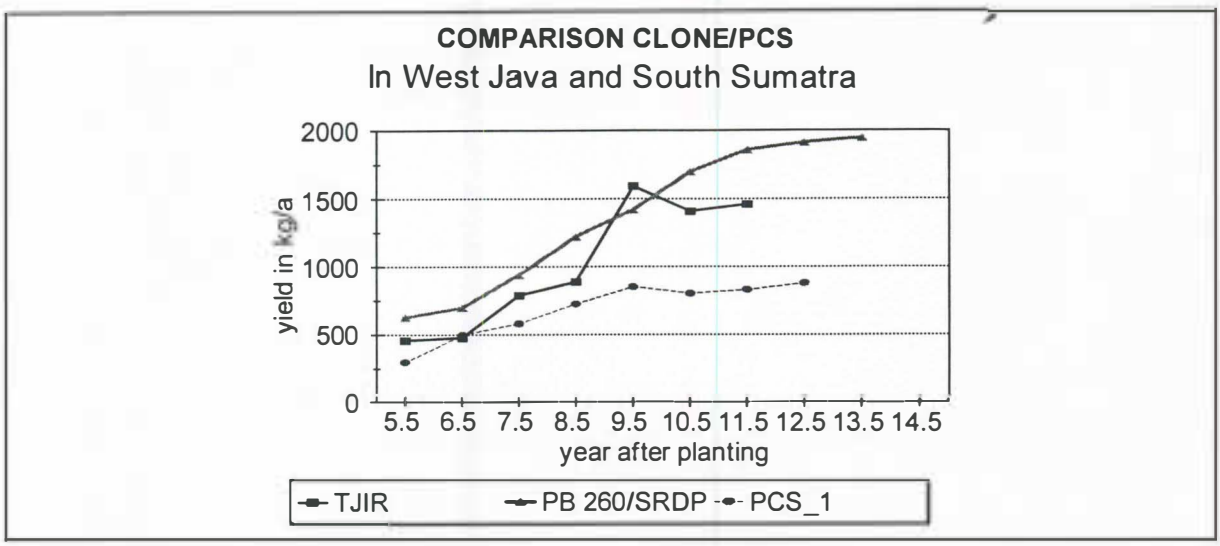


A study has been conducted at the IRRI station of Sembawa in South Sumatra (Delabarre, Sianturi and Nasipiah, pers comm.) on GT1 clonal seedlings (1315 trees) in the 1980's. The heterogeneity of production of this planting material (GT1 ill.) is high as for all seedling populations. 20 % of the trees gave 44 % of total production. The average yield was 1183 kg/ha for a D/2 tapping frequency (150 tappings/year, similar to farmers practices). Such a high tapping frequency increases the risk of brown bast disease on the tapping panel, leading to a serious decrease in production of the highest yielding trees (up to 20 % of the trees). This is equivalent to a loss of 25 % of the potential yield without brown blast, estimated at 1577 kg/ha). Such yields have been obtained with rigorous thinning and selection of seedlings at planting time. We should acknowledge that in reality, farmers never practice such selection and usually plant every available seedling into the field. Therefore, it is an illusion to expect high yields from clonal seedlings in smallholder conditions. The same conclusion can be drawn with polyclonal seedlings.

The polyclonal seedlings

Polyclonal seedlings are obtained by collecting seeds in polyclonal isolated gardens. North Sumatra estates used to plant this type of planting material up to the 1960's (in particular "PBIG" from the Prang Besar Estate in Malaysia). During the same period, farmers never had access to such planting material. The first series of polyclonal seedlings show low yields (maximum of 800 kg/ha/year) compared to first generation clones such as TJIR 1, and yields far below clones such as PB 260 (third generation). The average yield of smallholder plantations of PB260 from SRAP in South Sumatra is shown in Figure 2).

Figure 2



The current existing source of polyclonal seedlings in Indonesia

The only current source of polyclonal seedlings, BLIG (Bah Lias Isolated Garden), is located in North Sumatra at London Sumatra Estate. This estate is still advocating the use of BLIG, however this company itself is no longer planting BLIG for latex production, but for rubber wood production. Ease of planting (seeds) and a theoretically low cost (assuming no selection, and one seed produces one satisfactory plant) are cited as being the main advantages of BLIG. BLIG is the only real polyclonal seedling type available in Indonesia. This monopoly situation is therefore very dangerous for suppliers, and the supply itself is very limited indeed, as BLIG gardens hectarage is only 5 hectares. However, good yields can be obtained only with a severe thinning in both nursery and the fields, which leads to the use of more seeds required per tree in the field. In that case, BLIG is a planting material that is as expensive (if not more), than clones. Yields of BLIG or PBIG recorded in estates (LONDON SUMATRA) include a very severe thinning policy that is never likely to be the case with smallholders.

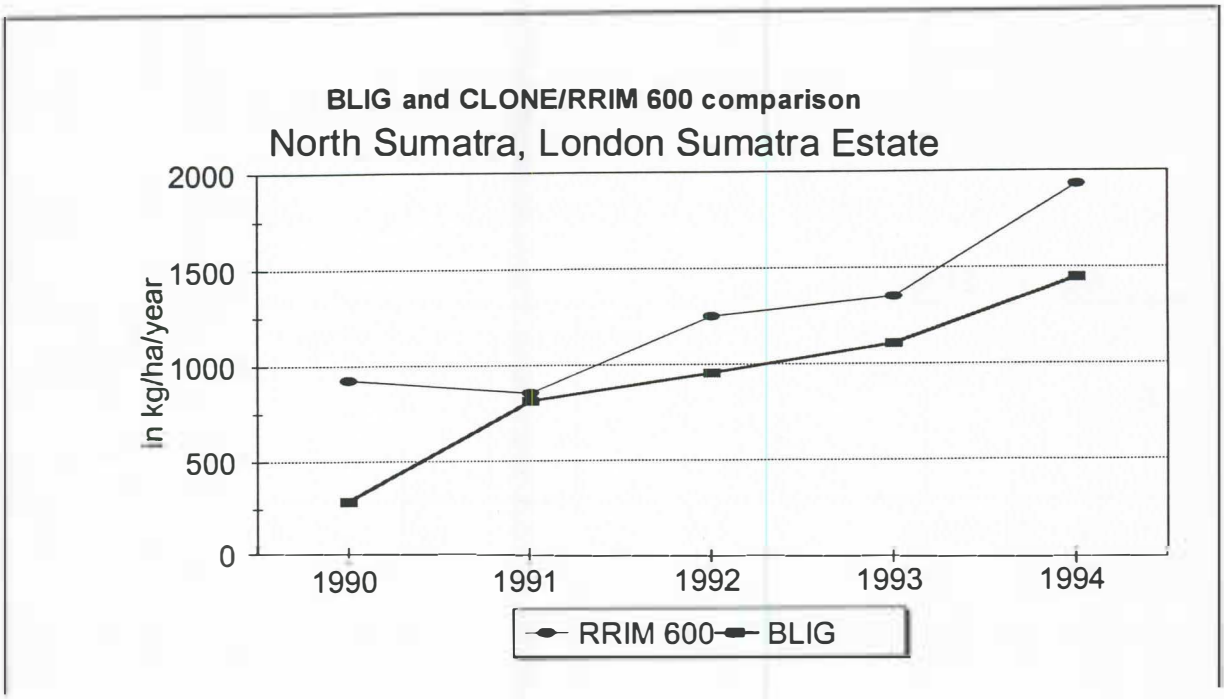
Yields records in LONSUM estate in North Sumatra are presented in table 5 for BLIG compared to RRIM 600, knowing the fact that BLIG is under estate management with a very high level of selection :

Table 5 ***PRODUCTION OF BLIG COMPARED TO CLONES AT PT. London Sumatra***

NORTH SUMATRA

Location	Year of planting		Number of trees		production in kg/ha/year						
	planting	material	Total	producing	1990	1991	1992	1993	1994	**Production accumulated**	in % of clone
Sei Rumbia (Sumut)	1984	BLIG	356	354	**244**	**865**	**1142**	**1187**	**831**		
Palang Isang (Sulsel)	1985	RRIM 600	381	363	**921**	**852**	**1249**	**1349**	**1928**	6299	
	1986	BLIG	391	391	**286**	**810**	**952**	**1105**	**1445**	4598	**73%**
	1987	BLIG	401	393		**241**	**666**	**932**	**1249**		
		GT1	402	389			**594**	**1309**	**1957**		
	1988	BLIG	409	390				**465**	**1001**		
	1989	BLIG	419	408				**421**	**774**		
	1990	BLIG	436	348					**331**		

*) Data from Palang Isang estate
**) Data obtained in December 1994
Source: Pusat Penelitian Karet, IRRI, 1995



The two major constraints of using BLIG are the following :

- the low availability of planting material (only 2 isolated gardens in North and South
- Sumatra both controlled by LONSUM), and,
- the low resistance of BLIG to leaf disease as one can observe in the West Pasaman area in West Sumatra province[2] (Penot, 1995). This last remark severely restricts the potential use of BLIG to areas without *Colletotrichum* disease risk, such as South-Sumatra province.

The clones

The first budding occurred in North Sumatra in 1916. In 1936, as many as 175 000 ha where planted with first generation clones in Sumatra.
Budding does not totally suppress the genotypic variability, but seriously reduces it (normally to less than 25 %) . Using homogeneous clones increases cost effectiveness of any input investment, as all trees will profit from it. Budding also does not transfer the full performance of the mother tree. That is the reason why it is necessary to test new clones for at least 15 years to confirm their performance and stability. The comparison between clones and improved seedlings, up to the 1940s', has been based on these first generation clones. These clones were not as high yielding as now and generally had quite poor secondary characteristics.

[2]West-Pasaman, and to a lesser extend East-Pasaman, are the only places in Indonesia where BLIG has been planted at large scale by Pro-RLK/GTZ project and DISBUN.

The first properly tested clones began to be available in 1934 in North Sumatra and West Java. The current clones, of the third generation, have excellent performances both in estates and in smallholdings according to clones typology. Most of them have the following characteristics : precocity (PB 260 is tapped at 3,. years of age at the Goodyear estate in perfect conditions, but most of them can be opened at 5 years old), very good vigour and growth (PB 260 and RRIC 100), high-yield (1800-2000 kg/ha for PB 260, 1700 kg for GT 1 in smallholdings in South-Sumatra, (Penot, 1993), and good resistance to leaf diseases.

The homogeneity of clones enables good tapping and good bark renewal, assuring a long production potential. Eventually, the frequency of tapping can be reduced to D3[3] without any production loss (and without use of stimulation) with clones like PB 260 and RRIC 100, leading to significant labour saving (33 % in the case of D3). The use of stimulant can even reduce the tapping frequency to D/4, if high labour costs necessitate this. Using clones gives the farmers room for further improvement in labour productivity, as well as a better final income from the rubber wood sales at the end of the plantation. This is not the case with seedlings, due to their conically shaped trunk (the wood can only be sold as firewood at a much lower price). One hectare of clonal trees may produce an average of 200 m3 of wood for timber or pulp.

[3]D/3 means a tapping frequency based on 3 days.

Productivity versus cost : improved planting material adoption

This trade-off is quite clear : clonal rubber adoption means high productivity, but also a higher cost of investment in terms of inputs and labour than jungle rubber, if planted either in monoculture or in RAS systems.

Cost of IGPM in a new plantation

IGPM	Cost per unit in Rp	Number of plants for 1 ha of plantation	Total cost of IGPM for 1 ha in rupiah
unselected seedlings (seeds) Jungle rubber	0	1000	0
clonal seedlings 4 seeds per planted tree	12.5	600 x 4 seeds	30 000
PCS (BLIG) 3 seeds for 1 planted tree no selection (transportation cost not included)	90	600 x 3 seeds	162 000
PCS (BLIG) 6 seeds per planted tree Medium level of thinning (transportation cost not included)	90	600 X 6 seeds	324 000
clone (produced by the farmers) 4 GT1 seeds = 50 Rp Grafting = 100 Rp budwood = 100 Rp Miscellaneous = 100 Rp	350 in polybag	600	210 000
clone : stump bought at private nursery and put into polybag 350 Rp/stump + 100 Rp/Polybag	450 in polybag	600	270 000
clone (produced by private nurseries)	1000 in polybag	600	600 000

Number of rubber trees required for 1 ha = 550 + 10 % for replacement = 600.

The cost of clones produced by farmers, or purchased from private nurseries (210 to 270 000 Rp), and that of BLIG (324 000 Rp assuming a medium level of selection) is within the same range. The advantage still goes to clones in that case for 2 reasons : cost is lower than that of BLIG (if BLIG is selected in the nursery), the supply of clones is better in most locations, and production as well as adaptation to local conditions is more efficient. On the other hand, in the case of polybagged clones supplied by a local private nursery (market price), the cost of clones is twice that of BLIG. However clones have the advantage of better productivity, homogeneity in production, labour saving during tapping and better leaf disease resistance (if the clone is well selected to local environment), although more weeding,, and therefore more labour during immature period is required.

Budded stumps can be purchased by farmers and planted in polybag in farmers' small nurseries without any technical problems. But the farmer has still to rely on clonal purity guaranteed only by the private operator, without any control or official certification which may lead to problems as farmers do not have any control over quality. The cost effectiveness is very low if the farmer is paying a high price for planting material which is no better than unselected seedlings. Budded stumps do not necessarily mean they are clones (the case of stumps budded with non clonal budwood). Therefore clonal purity should be guaranteed to farmers.

The level of production of BLIG will mainly depend on the level of selection through thinning. Generally, farmers will try to plant most of the stumps produced from purchased seeds, and we may expect in practice to have a very low level of thinning, leading to a lower production (probably around 1 000 kg/ha or less). In that case, of course the cost of seeds is lower (3 seeds per tree planted only). A better production might be expected, at least for the first 4 years (but no sufficient information after that period) with a medium level of thinning (estimated with a minimum 6 seeds per planted tree). The supply of BLIG is problematic: only two sources in North and South Sumatra. Transportation and seed viability (only 3 weeks after harvest) are very serious limitations.

So far, farmers' decisions about the type of planting material they use is highly dependent on income. According to a survey in South Sumatra (A Gouyon, 1995), 45 % of the farmers still use unselected seedlings , 22 % use GT1 seedlings for jungle rubber planting and 32 % use clones (60 % if income is above 5 millions Rp/year in 1990). It is also dependent on access to planting material and presence of estates, rubber projects or private nurseries. In South-Sumatra in remote villages (still considered as pioneer zones), the clone use rate is 1,5 %. In villages close to estates or PTP or private nurseries, the rate is 32 % (A Gouyon, 1995).

SELECTED BIBLIOGRAPHY

- Anon. *Note sur le caoutchouc indigéne de Sumatra*. Imp Portail. Saigon; 1933, Vietnam..
- Burkill HM. *Large scale variety trials of Hevea brasiliensis Muell-Arg on Malayan estates 1934-53*. Conference of Rubber Research Institutes in the Far East. Bogor, 952, Indonesia.
- Cramer P.J.S. *Clonal seedlings*. (Date of publication unknown). Wasseaar, Netherlands.
- Clément-Demanges A, Chapuzet , Legnaté H and Enjalric F. *Possibilités offertes par le matériel végétal hévéa sur les plantations en Afrique*. Paper presented at the IFC seminar, 15/9/1995, Montpellier, France.

Delabarre M, Sianturi and Nasipiah. *Production of improved rubber seedlings*. BPS/Sembawa, 1987, Indonesia, unpublished. Personal communication.
- Djikman M.J. *Rubber : Thirty years of research in the far east*. University of Miami Press. 1951, USA.
- Eshbach JM. *Mission report to Cambodia*. ICRAD/CIRAD, 1992, Paris, France.
- Holt EG. The Dutch native rubber industry. In 'The Rubber Age', 10 July 1926, Java, Indonesia.
- Luytjes A. *Expected production of native rubber in the DEI*. In 'The Rubber Age', 19 June 1928, Java, Indonesia.
- London Sumatra. *PBIG and clones yield performances in LONSUM estates*. Personal communisation from Dr Rasidin Anwar (IRRI Sungei Putih). 1991, Indonesia.
- London Sumatra. *Annual report 1993*. Indonesia.
- O Brien HE and De Silva CA. *Yields from young budded and seedling rubber*. Printed report. Indonesia. Date unknown (1945-1959).
- Penot E. *Report Mission : SRAP implementation in West-Sumatra*. May 1995. SRAP/ICRAF, Bogor, Indonesia.
- Penot E. *Rubber clones index in Indonesia*. CIRAD/IRRI/BPS. Sembawa, 1994, Indonesia.
- Newall W. *Advantages of clonal seedlings in the smallholder sector*. Draft paper, RISDA, 1985.
- RRIM. *Clonal seedlings trials : third and fourth report*. Planter's Bulletin n° 88 and 94. RRIM, 1967 and 1968, Malaysia.
- Van den Abeele. *Note sur la culture de l'hévéa aux Indes néerlandaises, en Malaisie et à Ceylan*. Publication de la Direction générale de l'Agriculture du Ministère des colonies. Paris, 1939, France.

ANNEX 2

- Presentation of the CIRAD Electrophoresis technique for clonal rubber identification

Résumé

Chez l'hévéa, la multiplication à grande échelle de matériel végétal non conforme peut gravement compromettre la rentabilité économique des plantations. Afin de réaliser, à un stade précoce de leur croissance, la caractérisation génotypique des clones, l'électrophorèse d'isoenzymes a été développée. Avec 98% de pouvoir de séparation pour les principaux clones cultivés, cette technique s'est révélée particulièrement performante. L'équipement nécessaire simple et le coût de fonctionnement relativement faible de cette technique permettent son application en routine à l'identification clonale de l'hévéa. Une unité mobile d'électrophorèse ou «laboratoire portable» a été créée en vue d'intervenir directement sur plantation pour effectuer des contrôles de conformité en jardins à bois de greffe. Elle a été utilisée avec succès en Côte d'Ivoire, en Indonésie, en Guyane et en Guadeloupe sur un grand nombre d'individus. Elle est proposée sous forme de missions d'expertise ou de transferts de technologie.

Abstract

Large-scale multiplication of *Hevea* planting material that is not true-to-type can seriously jeopardize the economic profitability of plantations. Isoenzyme electrophoresis has been developed to characterize clone genotypes at an early stage in their growth. This technique has proved particularly effective, with 98% separation ability for the main clones cultivated. As the equipment required is simple and operating costs are relatively low, *Hevea* clone identification using this technique has become routine. A mobile electrophoresis unit or «portable laboratory» has been developed for direct conformity checks in budwood gardens on plantations. It has been successfully used in Côte d'Ivoire, Indonesia, French Guiana and Guadeloupe on many individuals. It is proposed through assessment missions or technology transfers.

Resumen

Para el hevea, la multiplicación a gran escala de material vegetal que no es conforme puede comprometer gravemente la rentabilidad económica de las plantaciones. Con el fin de realizar, en una fase precoz de su crecimiento, la caracterización genotípica de los clones, se ha desarrollado la electroforesis de isoenzimas. Esta técnica se ha revelado particularmente eficiente con un 98% de poder de separación de los principales clones cultivados. Su aplicación a la identificación clonal del hevea pudo realizarse de una forma rutinaria, siendo sencillos los equipos necesarios, de un costo de funcionamiento relativamente bajo. Se ha creado una unidad móvil de electroforesis o «laboratorio portátil» con el fin de intervenir directamente en el campo para efectuar controles de conformidad en jardines clonales. Se aplicó, con éxito, la técnica en Côte d'Ivoire, en Indonesia, en Guyana y en Guadalupe en un gran número de individuos. Está propuesta en forma de misiones de peritaje o de transferencia de tecnología.

Electrophoresis application to *Hevea* clone identification

Leconte A., Lebrun P., Nicolas D., Seguin M.
CIRAD-CP, BP 5035, 34032 Montpellier Cedex 1, France

Yields from a rubber plantation depend on the identity of its trees. Isozyme electrophoresis checks clone legitimacy right from the budwood garden stage, i.e. before they are planted for several decades.

Hevea brasiliensis, the main source of natural rubber, currently covers 9.5 million hectares worldwide and the varieties (clones) grown in virtually all the plantations are vegetatively propagated by budding.

This type of propagation uses considerable amounts of budwood, which is produced in special agricultural structures called «budwood gardens».

These budwood gardens have to be «true-to-type», but many sources of error can lead to impurities: identification panel errors, dubious supply sources, suckers not removed from rootstocks, etc. This subsequently leads either to wrong naming, or to the existence of a certain percentage of plants in a plot that do not belong to the clone being multiplied.

The economic impact of errors in a budwood garden is sometimes considerable:

- a clone may be budded instead of another, whereas its agronomic characteristics such as susceptibility to wind damage or diseases are unsuitable for the zone in question,
- the impurity rate in a budwood garden is greatly magnified in a plantation; yields and economic profitability can be substantially reduced (box 1).

In budwood gardens, the varieties cultivated (budded clones) have few distinctive morphological characters and there is currently no totally effective way of telling clones apart using visual criteria.

One *Hevea* visual recognition technique is based on a qualitative assessment of around 20 leaf characters (Recueil de fiches de clones *Hevea*, 1993). This method offers the advantage of being usable in very young budwood gardens, but it is not foolproof: in fact, it is necessary to observe a large number of leaves and individuals to obtain an accurate specification. It also requires a lot of practice and even special training. A reliable frame of reference is also required, which remains to be created for most clones. Specialists claiming to be able to recognize clones using this technique are few and far between and their judgement should be viewed with caution: a survey carried out in Indonesia showed that a specialized technician can recognize 80% of the clones in a fairly pure budwood garden, but this success rate falls substantially if the garden is highly mixed. With this method, one clone can also be confused with another.

Another identification technique is based on seed observations. In fact, each clone has a particular type of seed (Recueil de fiches de clones *Hevea*, 1993), but this method can only be applied in adult plantations. It requires an experienced eye and a reliable frame of reference. However, it is a good way of judging whether a plot is pure or contains a mix of clones.

In view of these factors, consideration was given to using genetic molecular markers capable of genotypic characterization of clones at an early stage in their development.

In Asia, a few attempts were made to identify clones based on electrophoretic separation of proteins in latex serum (Walujono and Agung Suseno, 1973; Walujono and Effendi, 1976; Yeang *et al.*, 1977), but did not lead to the extension of reliable protocols that could be used on a routine basis.

Over the past ten years or so, the isozyme electrophoresis technique (box 2) has been developed on rubber in the CIRAD laboratories. This technique, which was first used to study the genetic diversity of selected and cultivated clone populations («Wickham» clones) and of germplasm obtained from surveys in the Amazon basin (Chevallier, 1988; Chevallier *et al.*, 1988), proved particularly effective and was applied to clone identification. More recently, genetic fingerprinting by RFLP (Restriction Fragment Length Polymorphism) has been developed and has proved even more effective than isozymes for *Hevea* clone identification (Seguin, 1992; Besse *et al.*, 1993). However, RFLP development is currently being held back by the length of the experiments, the use of radioactive isotopes and the cost of molecular biology techniques.

Isozyme electrophoresis

Thus, the isozyme technique remains valid for large-scale experiments. It can provide veritable genetic fingerprints at enzyme level, based on the genetic variability of clones expressed in terms of isoenzymatic variability. Isozyme electrophoresis has been used for varietal identification of many plants and has been extended to *Hevea*, based on leaf protein extracts and using 12 enzyme systems developed on starch gel (Lebrun and Chevallier, 1990). It has been tested on numerous genotypes.

Its discrimination capacity is remarkable: a study of 73 clones from the Far East (Wickham clones) revealed 71 different genotypes, corresponding to 98% separation capacity for the clones in this population.

It ensures reliable recognition of the clones already described and inventoried in a data base. This data base now contains the isoenzymatic references of 254 selected clones (114 Wickham clones, 81 IRCA clones and 59 South American clones).

[illegible]

A level of impurity, however small, in a budwood garden (B.G.) is substantially magnified in plantations, causing a drop in yields and in the economic profitability of the areas planted.

This can be illustrated by the following simulation:

- Setting up one hectare of budwood garden costs FF 80,000.
- It can supply material for 250 ha of plantings/year, i.e. 2,500 ha of plantings in ten years (average life span of a B.G.).
- Given a B.G. comprising 90% of a high-yielding clone, which would produce 2 t/year (mean of the first ten years' tapping) and 10% of planting material that is not true-to-type, which would produce 1.5 t/year.
- The shortfall from a plantation set up from such a B.G. compared to a plantation set up from a pure B.G. will be 50 kg/ha/year, meaning, for the 2,500 ha set up from the initial one hectare B.G.: 50 kg x 2,500 = 125 t/year. At FF 6,000 per tonne of rubber, the lost opportunity would be FF 0.75 million per year!

Let us apply this example to a 5,000 ha development project to be implemented over five years, with 5 ha of B.G., which would cost FF 400,000 to set up.

Let us lower the impurity rate in the B.G. to 5% (since it is a new project) and limit the production potential of the material that is not true-to-type to -20% compared to the reference clone.

- The shortfall to be made up would be 40 kg/ha/year, i.e. 200 t/year for the plantation,
- or FF 1.2 million/year,
- over twenty years: FF 24 million compared to the FF 0.4 million spent on setting up the B.G.!

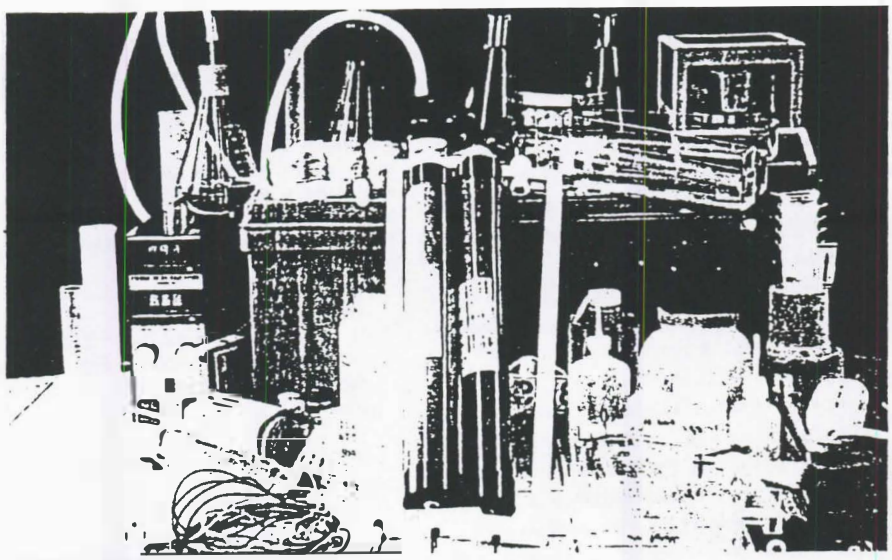


Photo 1 : Laboratoire portable d'électrophorèse
Portable electrophoresis laboratory

Photo P. Lebrun

Photo 2 : Contrôle de conformité à Finca Entre Rios (Guatemala). Récolte des échantillons (feuilles) en jardin à bois
Conformity check at Finca Entre Rios (Guatemala). Collection of samples (leaves) from a budwood garden

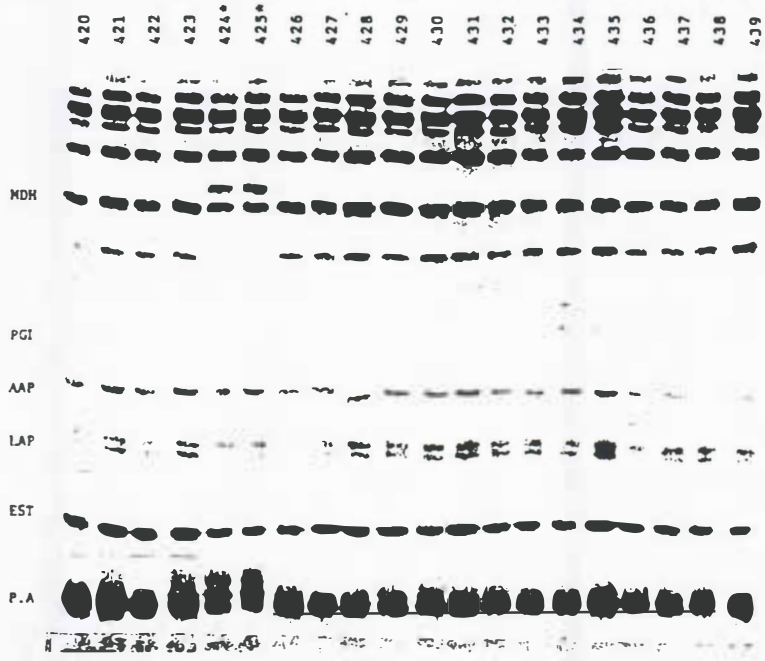


Photo 3 : Contrôle de conformité d'un jardin à bois de PB 235
420...439 : numéros d'identification des souches en J.B.
*génotypes non conformes au PB 235
Conformity check in a PB 235 budwood garden
420...439: identification numbers of budded stumps in B.G.
**genotypes not conforming to PB 235*

Isozyme electrophoresis is therefore the most reliable, simplest and cheapest *Hevea* clone identification method currently available. The CIRAD Tree Crops Department (CIRAD-CP) uses it on a routine basis, proposing clonal conformity checks in budwood gardens and service analyses for internal requirements. This was the case for analyses carried out jointly with the *Hevea in vitro* team, to check clone conformity in the greenhouse prior to micropropagation. Checks based on a sample of plants leaving tubes have also been made, confirming the genetic identity of material multiplied *in vitro*.

Nevertheless, the isozyme electrophoresis technique has one drawback. It can only be used on living material collected in the immediate vicinity of the laboratory, or on material preserved by freeze-drying, which requires complex, expensive equipment.

Portable laboratory

In order to extend isozyme application, the protocols and equipment required have been simplified. CIRAD-CP researchers and technicians have designed a mobile electrophoresis unit or «portable laboratory». The equipment and products used to analyze 500 individuals have been reduced to such a point that they all fit into a trunk: 100 x 55 x 35 cm (photo 1). With this equipment, an expert can carry out conformity checks directly in a plantation. The different operations merely require on-site availability of a clean room with a work bench, electricity, running water and a fridge-freezer.

Since its design, this portable laboratory and its operator have carried out assessments in very different locations, for research centres or in estate plantations: Côte d'Ivoire (IDEFOR/DPL, SOGB), Indonesia (IPARD), French Guiana and Guadeloupe (CIRAD collections). In all these cases, the portable laboratory has proved effective and its use on almost 1,500 individuals has confirmed the existence of clonal conformity errors in budwood gardens and plantations, at varying rates depending on the clones and sites.

Very recently, two clone conformity missions were carried out in Guatemala, in conjunction with Gremial de Huleros (rubber growers' association), during which conformity checks were made on 14 south coast plantations (photo 2) and the technology was successfully transferred, with the delivery of a portable laboratory and training for technicians.

In French Guiana, an electrophoresis unit has been set up in the CIRAD laboratories in Kourou, for regular checks in the collection budwood gardens and to certify the conformity of the planting material distributed, by electrophoresis.

The technique is currently being transferred to the Michelin estates in Brazil.

The following two examples, obtained during assessment missions with the portable laboratory, are typical of the possible electrophoresis applications as regards clone conformity.

Conformity check in a PB 235 budwood garden

Following an analysis in a PB 235 budwood garden, differences in the number and position of bands for the MDH (Malate Dehydrogenase) and AP (Acid Phosphatase) systems revealed that 2 out of the 20 individuals analyzed had a different zymogram, hence genotype, from the other individuals (Nos. 424 and 425, photo 3). These two individuals were not true-to-type. They did not belong to clone PB 235.

Case of PR 261 in Africa

The example of clone PR 261 in an African country is also typical of how well the portable laboratory works.

Initially, enzymatic analysis of a PR 261 «source» budwood garden revealed that the clone multiplied under this name had a different genotype from the Asian PR 261. This African clone was therefore renamed AF 261. It could therefore be expected that all the PR 261 plantations in the country were in fact AF 261.

Moreover, field observations in the same country in a PR 261 monoclonal plot had revealed the existence of 2 phenotypes:

- an A type tree, which was in the majority, corresponding to high-yielding material,
- a B type tree, which was in the minority, with high susceptibility to wind damage, leading to yield losses after several years.

Isozyme analysis first performed on the trees in this plantation, revealed that:

- the two phenotypes, A and B, did indeed correspond to different genotypes. Type B could not be attributed to any known clone,
- type A itself was genetically heterogeneous and made up of two genotypes: the first, in the majority, effectively corresponded to AF 261, the second could not be attributed to any known clone.

Thus, this «PR 261» plot proved to be an AF 261 plot, «contaminated» by two unknown genotypes, and none of the three genotypes corresponded to the Asian PR 261.

The budwood garden corresponding to the plot previously studied was then analyzed using the portable laboratory. The isoenzymatic genotype, established for a sample of 81 rootstocks, showed that:

- the clonal conformity errors came from the budwood garden itself and not from budding errors, with the three genotypes identified in the plantation occurring in equal proportions in the budwood gardens,
- these clonal impurities were not detectable with the naked eye at the juvenile stage, which demonstrated the merits of using isoenzymatic markers *in situ*.

Conclusion

During these different operations, the portable electrophoresis laboratory proved its reliability for detecting *Hevea* clone conformity errors in the field.

However, this technique is limited by the number of individuals that can be analyzed each day (25 on average). Its most effective use is for budwood garden checks. In the event of detected heterogeneity, it can, through rational sampling, pinpoint with certainty those rootstocks that are true-to-type and which will be used to set up new, perfectly pure budwood gardens. In turn, these new budwood gardens should be checked regularly, at the time of periodic cutting back operations, which are potential sources of error.

Apart from specific cases, it cannot be used to solve identification problems after the event, if there are clone mixes in plantations. Neither is it a way of identifying clones of unknown origin «in the dark», but it can be used to check whether a clone corresponds to the name attributed to it, by comparison to a reference.

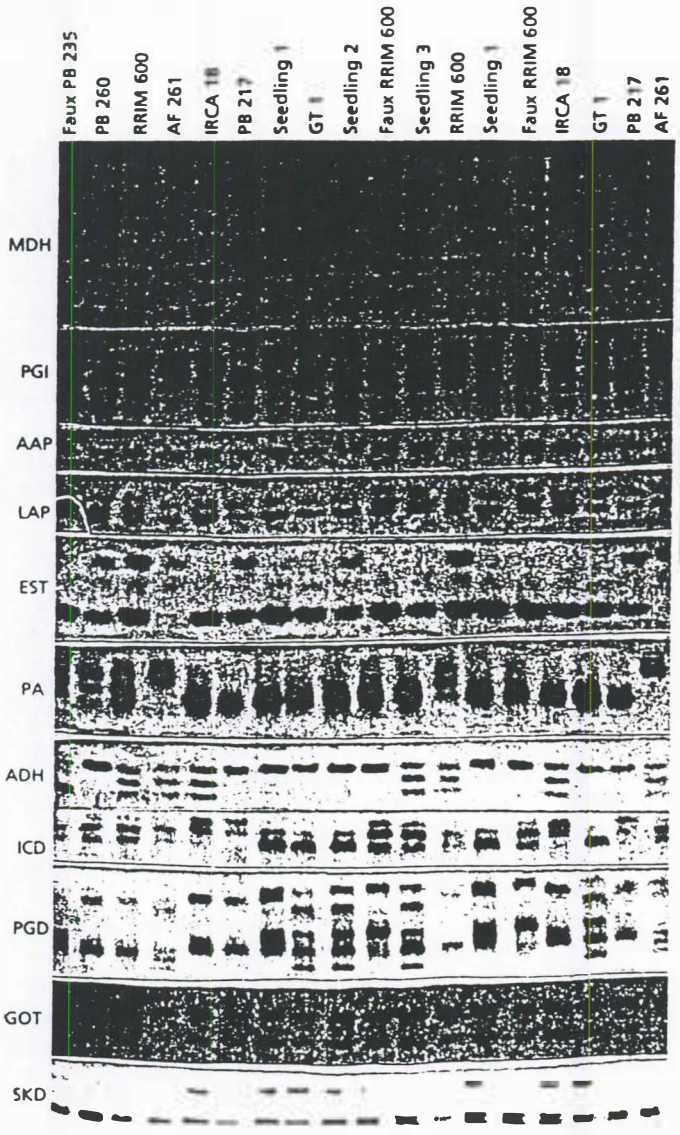
Use of the portable laboratory should be expanded, either through assessment missions or technology transfers. The latter option is currently being considered for forthcoming clonal conformity checks in Indonesia and Côte d'Ivoire.

Apart from its direct application in planting material production for plantations, the isozyme electrophoresis technique offers other possible applications, developed by the CIRAD laboratories in Montpellier, as back-up for *Hevea* genetic improvement programme: checking progeny legitimacy, studying open pollination, germplasm management.

Today, isozyme electrophoresis used for *Hevea* clone identification combines reliability, easy use and low cost. Whilst its ability to distinguish between genotypes is less than that of molecular biology methods that directly analyze DNA (RFLP), it remains competitive in that these latter methods are too cumbersome for application in the field and are reserved for highly specific use in the laboratory. Nevertheless, new molecular biology tools, such as PCR (Polymerase Chain Reaction) could open up new prospects in the field of clone identification, combining the power of DNA analysis with protocols as simple as for isozymes and automation possibilities.

ozyme electrophoresis

ectrophoresis is a biochemical technique used for protein separation; its principle has beeen know since the end of the 19th century



	Faux PB 235	PB 260	RRIM 600	AF 261	IRCA 18	PB 217	Seedling 1	GT 1	Seedling 2	Faux RRIM 600	Seedling 3	RRIM 600	Seedling 1	Faux RRIM 600	IRCA 18	GT 1	PB 217	AF 261
MDH	23	23	23	22	22	33	22	22	22	22	23	23	22	22	22	22	33	22
PGI	13	11	13	23	13	11	33	13	11	13	11	13	33	13	13	13	11	23
AAP	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
LAP	24	24	24	22	22	22	22	22	22	24	24	24	22	24	22	22	22	22
EST	11	16	16	66	11	16	11	11	16	11	11	16	11	11	11	11	16	66
PA	12	12	12	22	11	11	11	11	11	11	11	12	11	11	11	11	11	22
ADH	22	33	23	23	23	33	33	33	33	33	23	23	33	33	23	33	33	23
ICD	34	34	34	34	44	44	33	33	33	34	34	34	33	34	44	33	44	34
PGD	23	22	22	12	22	22	23	13	13	33	13	22	23	33	22	13	22	12
GOT	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
SKD	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33

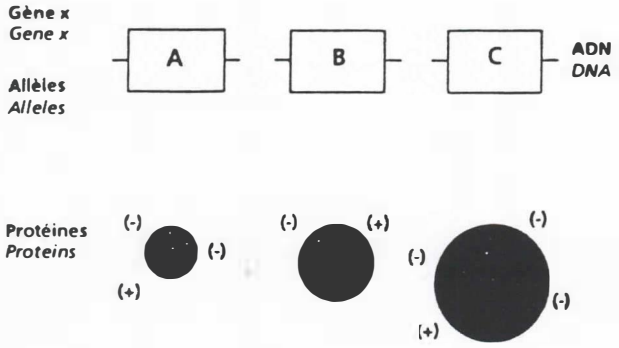
MDH : Malate déshydrogénase
PGI : Phospho glucose isomérase
AAP : Alanyl amino peptidase
LAP : Leucine amino peptidase
EST : Esterase
PA : Phosphatase acide
ADH: Alcool déshydrogénase
ICD : Isocitrate déshydrogénase
PGD : Phosphogluconate déshydrogénase
GOT : Glutamate oxaloacétate transaminase
SKD : Shikimate déshydrogénase

La variabilité génétique entre individus se traduit par des variations du nombre et de la position des bandes d'isozymes. Des analyses génétiques ont permis de traduire les profils izoenzymatiques (ou zymogrammes) obtenus en termes de génotypes. L'exemple ci-contre présente, pour 11 locus enzymatiques, les zymogrammes de quelques plants d'hévéa (clones et seedlings), ainsi que leur interprétation en termes d'allèles. Les arbres d'un même clone présentent le même nombre et la même position des bandes.

Genetic variability between individuals is reflected in variations in the number and position of the isozyme bands. Genetic analyses have enabled interpretation of the isoenzymatic banding patterns (or zymograms) obtained in terms of genotypes. The example opposite shows the zymograms of a few rubber plants (clones and young plants from seeds or seedlings) for 11 enzymatic loci, along with their interpretation in terms of alleles. The trees of a given clone have the same number of bands in the same position.

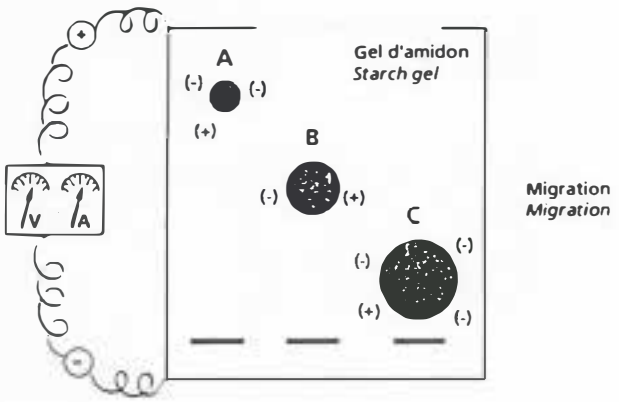
L'électrophorèse d'isozymes

L'électrophorèse est une technique biochimique utilisée pour la séparation des protéines ; son principe est connu depuis la fin du 19ème siècle



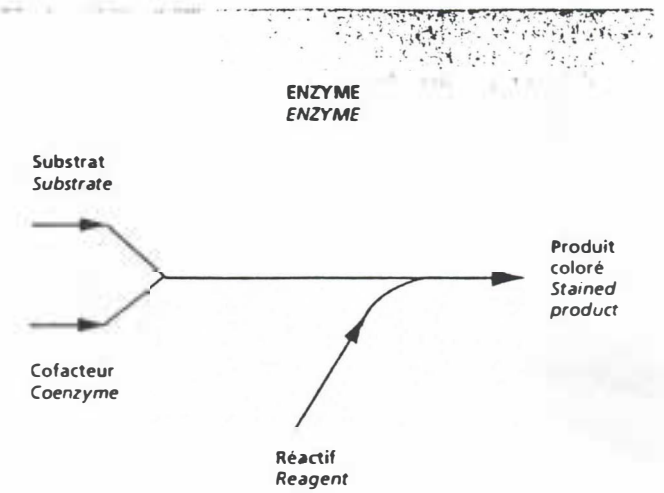
1 Les protéines sont constituées d'un enchaînement d'acides aminés. Dans la plante, leur synthèse est contrôlée par les parties codantes de l'ADN : les gènes.
Proteins consist of a chain of amino acids. In plants, their synthesis is controlled by the coding parts of DNA: genes.

2 Des extraits protéiques sont obtenus par broyage de feuilles en présence d'un tampon approprié.
Proteins extracts are obtained by crushing leaves in an appropriate buffer.



Dépôts d'extraits protéiques
Protein extract deposits

3 Déposés dans un support gélifié, les extraits protéiques sont soumis à un champ électrique. Les protéines se séparent en fonction de leur taille et de leur charge électrique
After being deposited on a gel medium, the protein extracts are subjected to an electric field. The proteins separate according to their size and electrical charge



4 Les enzymes sont des protéines jouant le rôle de catalyseurs biologiques. Leur activité est spécifique d'un substrat et d'un cofacteur particuliers. En présence de leur substrat, de leur cofacteur et d'un réactif approprié, une coloration apparaît dans le gel à l'endroit où la protéine enzymatique s'est positionnée au terme de la migration.
Enzymes are proteins that act as biological catalysts. Their action is specific to a given substrate and coenzyme. In the presence of their substrate, coenzyme and appropriate reagent, the gel becomes stained where the enzymatic protein comes to rest after migration.

5 Ces bandes colorées correspondent à des isozymes, c'est-à-dire à des enzymes possédant une même activité catalytique, et qui sont codées soit par des gènes différents soit par des allèles différents d'un même gène.
These stained bands correspond to isozymes, i.e. enzymes with the same catalytic activity, which are coded either by different genes, or by different alleles of a given gene.

ANNEX 3

- Visual checking of clonal purity by Sembawa for PSSP budwood gardens : main results.

Lok. Pijoan

Tabel 1. Hasil pemurnian kebun entres di Desa Pijoan kec. Jambi Luar Kota Kab. Batanghari, Jambi.

K L O N	BLOK	JUMLAH TEGAKAN SEBELUM PEMURNIAN	HASIL PEMURNIAN BPM 24 (1)	PR 261 (2)	Klon Lain (3)	JUMLAH SETELAH PEMURNIAN
BPM 1	2	1.143	-	4	22	1.121
	6	762	-	10	22	740
	7	1.919	-	10	43	1.876
	Jumlah	3.824	-	24	87	3.737

K L O N	BLOK	JUMLAH TEGAKAN SEBELUM PEMURNIAN	HASIL PEMURNIAN BPM 1 (1)	PR 261 (2)	Klon Lain (3)	JUMLAH SETELAH PEMURNIAN
BPM 24	1	1.135	11	2	35	1.100
	3	1.446	6	10	37	1.409
	8	1.901	39	11	64	1.837
	9	1.066	32	9	13	1.053
	Jumlah	5.548	88	32	149	5.399

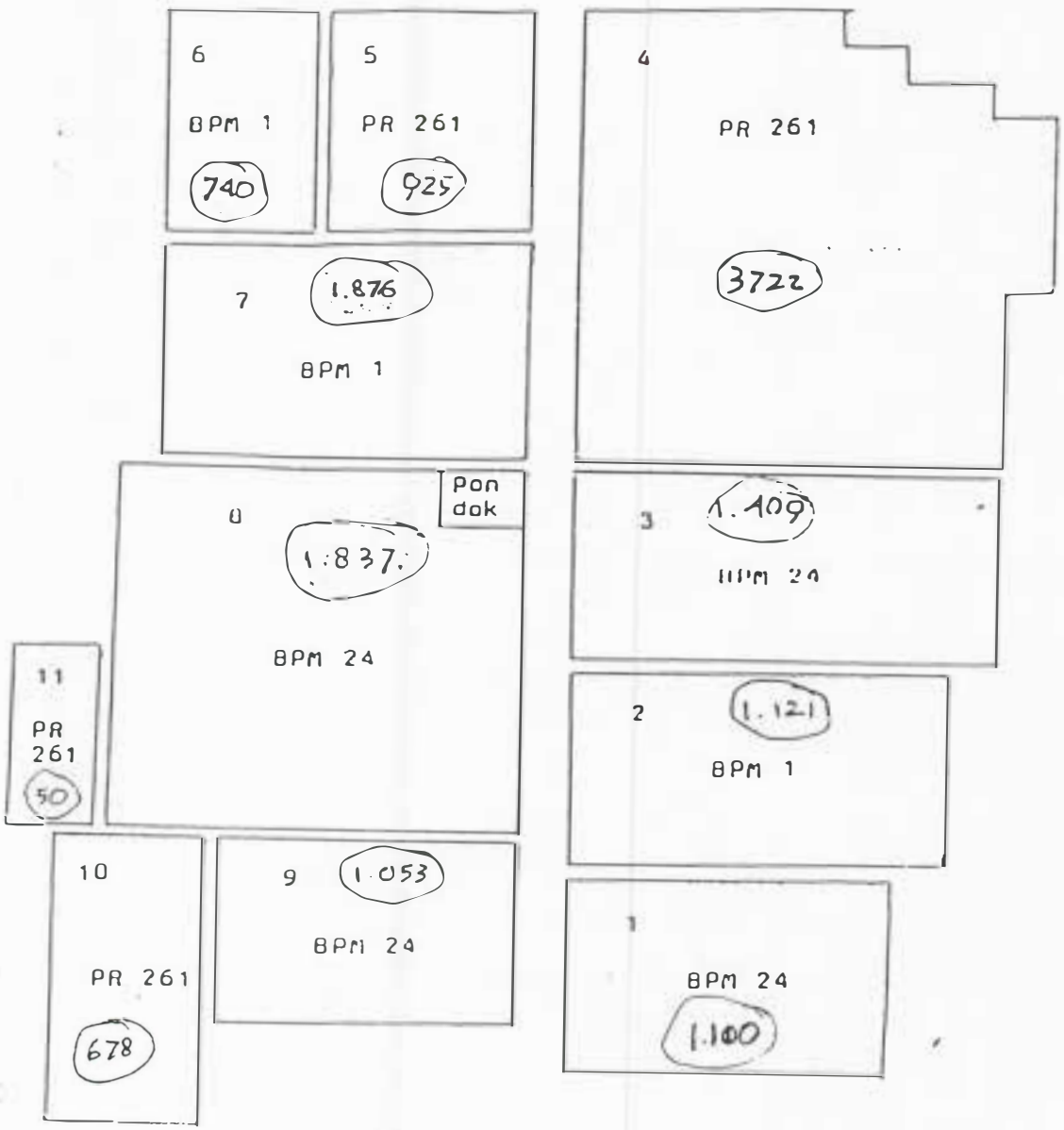
K L O N	BLOK	JUMLAH TEGAKAN SEBELUM PEMURNIAN	HASIL PEMURNIAN BPM 1 (1)	BPM 24 (2)	Klon Lain (3)	JUMLAH SETELAH PEMURNIAN
PR 261	4	3.760	5	-	38	3.722
	5	946	5	-	21	925
	10	692	45	3	14	678
	11	50	5	-	-	50
	Jumlah	5.448	60	3	73	5.375
TOTAL		14.820			309	14.511

Keterangan : (1) = tanda cat warna merah satu buah
(2) = tanda cat warna merah dua buah
(3) = sudah dimusnahkan

Lampiran 1

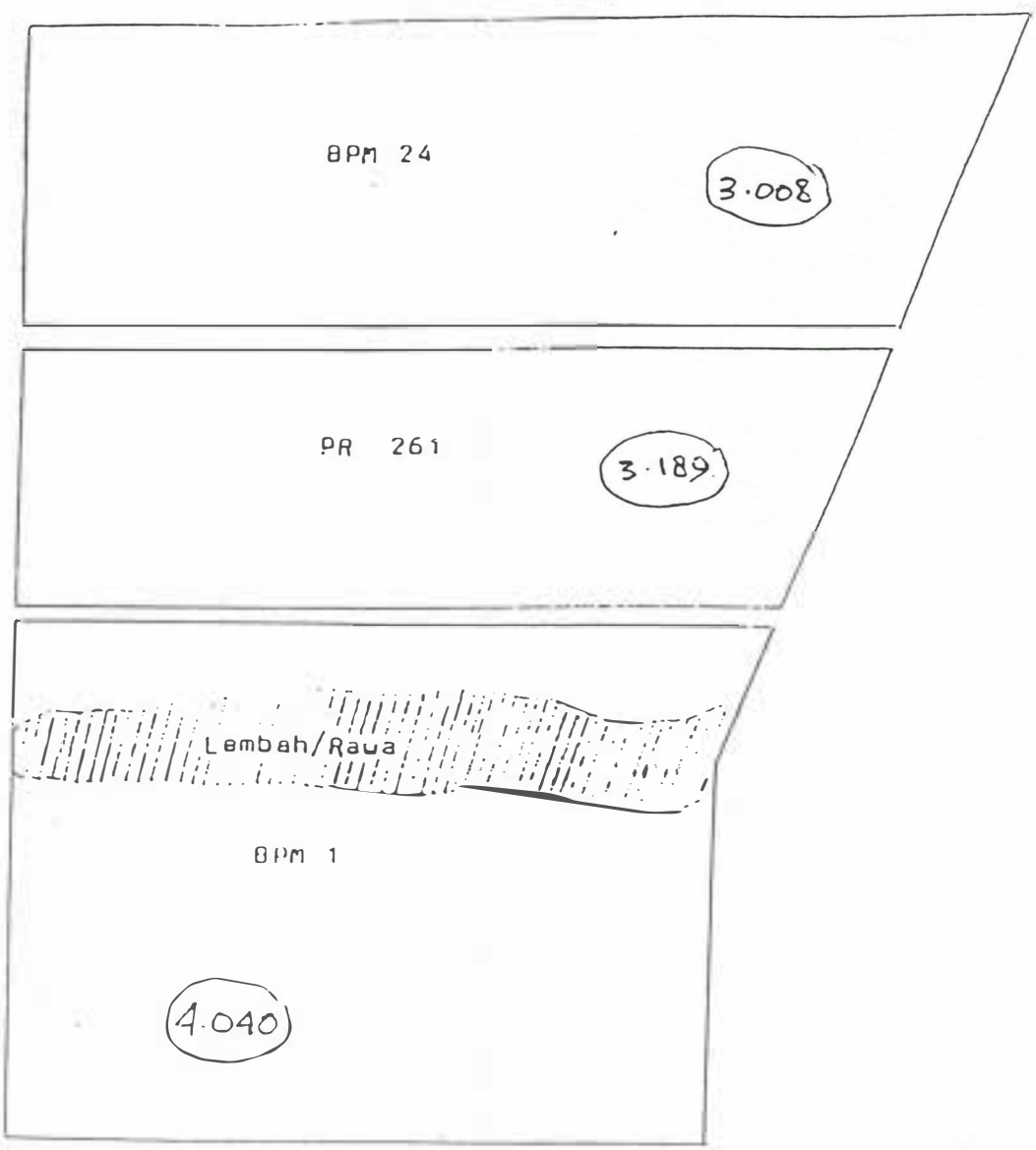
DENAH KEBUN ENTRES DI DESA PIJOAN

KEC. JAMBI LUAR KOTA KAB. BATANGHARI, JAMBI



Lampiran 2

DENAH KEBUN ENTRES DI DESA SINAMAT
KEC. MUARA BUNGO KAB. BUNGO TEBO, JAMBI



Desa Sinamat

Tabel 2. Hasil pemurnian kebun entres di Desa Sinamat Kec. Muara Bungo Kab. Bungo Tebo, Jambi

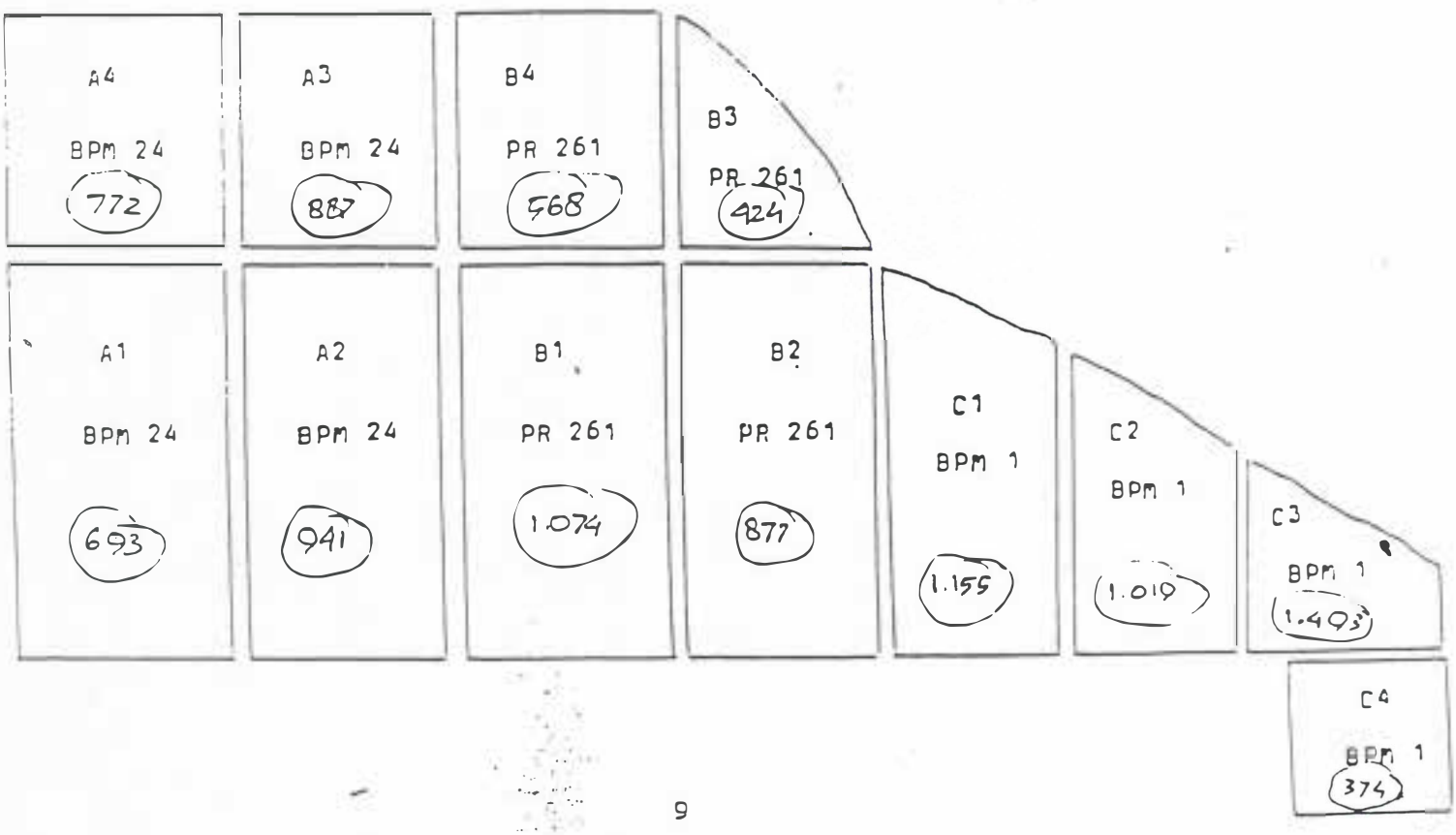
K L O N	BLOK	JUMLAH TEGAKAN SEBELUM PEMURNIAN	HASIL PEMURNIAN BPM 24 (1)	PR 261 (2)	Klon Lain (3)	JUMLAH SETELAH PEMURNIAN
BPM 1	-	4.190	39	357	150	4.040

		JUMLAH TEGAKAN SEBELUM PEMURNIAN	HASIL PEMURNIAN BPM 1 (1)	PR 261 (2)	Klon Lain (3)	JUMLAH SETELAH PEMURNIAN
BPM 24	-	3.115	99	125	107	3.008

		JUMLAH TEGAKAN SEBELUM PEMURNIAN	HASIL PEMURNIAN BPM 1 (1)	BPM 24 (2)	Klon Lain (3)	JUMLAH SETELAH PEMURNIAN
PR 261	-	3.362	176	111	173	3.189
JUMLAH		10.667			430	10.237

Keterangan : (1) = tanda cat warna merah satu buah
(2) = tanda cat warna merah dua buah
(3) = sudah dimusnahkan

Lay Longline



Desa Langling

Tabel 3. Hasil pemurnian di Desa Langling Kec. Bangko Kab Sarko Jambi.

KLON	BLOK	JUMLAH TEGAKAN SEBELUM PEMURNIAN	HASIL PEMURNIAN BPM 24 (1)	PR 261 (2)	Klon Lain (3)	JUMLAH SETELAH PEMURNIAN
BPM 1	C1	1.188	14	84	33	1.155
	C2	1.033	10	5	14	1.019
	C3	1.525	10	25	32	1.493
	C4	385	10	3	11	374
	Jumlah	4.131	44	117	90	4.041

KLON	BLOK	JUMLAH TEGAKAN SEBELUM PEMURNIAN	HASIL PEMURNIAN BPM 1 (1)	PR 261 (2)	Klon Lain (3)	JUMLAH SETELAH PEMURNIAN
BPM 24	A1	710	14	33	17	693
	A2	953	35	56	12	941
	A3	899	15	29	12	887
	A4	793	58	30	21	772
	Jumlah	3.355	122	148	62	3.293

KLON	BLOK	JUMLAH TEGAKAN SEBELUM PEMURNIAN	HASIL PEMURNIAN BPM 1 (1)	BPM 24 (2)	Klon Lain (3)	JUMLAH SETELAH PEMURNIAN
PR 261	B1	1.091	16	5	17	1.074
	B2	890	19	21	13	877
	B3	437	21	7	13	424
	B4	586	13	18	18	568
	Jumlah	3.004	79	51	61	2.943
TOTAL		10.490			213	10.277

Keterangan : (1) = tanda cat warna merah satu buah
(2) = tanda cat warna merah dua buah
(3) = sudah dimusnahkan

ANNEX 4

- BANDES programme survey : main results

BANDES BUDWOOD GARDEN AND NURSERIES SURVEY

Bundes Nurseries survey

3 Kabupaten : 1 Batang hari 2. Bungi Tebo. 3. Sarolangun Bangko. The Village have been surveyed are :

A. In Kabupaten Batang Hari :

1.	Desa Ladang Panjang	Kecamatan Mestong
2	Desa Talang Kerinci	Kecamatan Mestong
3	Desa Kebon IX	Kecamatan Mestong
4	Desa Sengeti	Kecamatan Sekernan
5	Desa Sungai Bertam	Kecamatan Jambi Luar Kota
6	Desa Tebing Tinggi	Kecamatan Pemayung
7	Desa Simpang Kubu Kandong	Kecamatan Pemayung
8	Desa Tenam	Kecamatan Ma. Bulian

B. In Kabupaten Bungo Tebo :

1	Desa Sepungur	Kecamatan Muara Bungo
2	Desa Babeko	Kecamatan Muara Bungo
3	Desa Simpang Babeko	Kecamatan Muara Bungo
4	Desa Tanjung Menanti	Kecamatan Muara Bungo
5	Desa Purwo Bakti	Kecamatan Muara Bungo
6	Desa Sungai Arang	Kecamatan Muara Bungo
7	Desa Muara Buat	Kecamatan Rantau Pandan
8	Desa Rantau Duku	Kecamatan Rantau Pandan
9	Desa Tanjung Agung	Kecamatan Rantau Pandan
10	Desa Mangun Jaya	Kecamatan Rantau Pandan
11	Desa Tebing Tinggi	Kecamatan Rantau Pandan
12	Desa Leban	Kecamatan Rantau Pandan
13	Desa Datar	Kecamatan Rantau Pandan

C. In Kabupaten Sarolangun Bangko

1.	Desa Mentawak	Kecamatan Bangko
2.	Desa Biuku Tanjung	Kecamatan Bangko
3	Desa Pulau Rengas	Kecamatan Bangko
4.	Desa Sungai Ulak	Kecamatan Bangko
5.	Desa Tanjung Nibung	Kecamatan Bangko
6.	Desa Titian Teras	Kecamatan Bangko
7.	Desa Salam Buku	Kecamatan Bangko
8.	Desa Aur Duri	Kecamatan Bangko
9.	Desa Tambang Baru	Kecamatan Tabir

f Bandes project in Jambi Province

Desas's Name		BUNDES PROJECT					
		Year 1 (1993/94)			Year 2 (1994/95)		
		Seeds	Seedlings	Stumps	Seeds	Seedlings	Stups
A. Batang Hari							
1	DesaTenam	20.000	6.200	9.800	48.000	28.000	12.000
2	Sungai Bertam	25.000	5.000	10.000	35.000	2.000	18.000
3	Sengeti	25.000	6.000	9.000	-	-	-
4	Kebon IX	25.000	9.000	11.000	48.000	12.000	18.000
5	Tl Kerinci	25.000	11.000	9.000	48.000	17.000	16.000
6	Ld. Panjang	25.000	14.000	1.000	40.000	0	10.000
7	Tb. Tinggi	30.000	3.000	12.000	-	-	-
8	Sp. Kubu Kandang	40.000	5.000	20.000	-	-	-
B. Muara Tebo							
9	Desa Datar	25.000	14.000	1.000	50.000	18.000	2.000
10	Leban	25.000	13.000	0	-	-	-
11	Sepunggur	25.000	12.000	0	50.000	24.000	0
12	Tb. Tinggi	25.000	13.500	0	50.000	23.000	0
13	Mangun Jayo	25.000	12.000	0	25.000	10.000	0
14	Rantau Duku	25.000	9.000	1.000	50.000	0	0
15	Sp. Bebeko	25.000	10.000	5.000	50.000	28.000	2.000
16	Muara Buat	25.000	18.000	2.000	50.000	20.000	12.000
17	Babeko	25.000	13.000	6.000	50.000	18.000	2.000
18	Tj. Agung	25.000	12.500	120	50.000	21.000	0
19	S. Agang	25.000	11.000	1.000	50.000	20.000	0
20	Purwo Bakti	25.000	4.200	10.800	-	-	-
21	Tj. Menanti	25.000	15.000	0	50.000	2.000	18.000
C. SARKO							
22	Salam Buku	100.000	48.000	0	30.000	16.000	0
23	Titian Teras	100.000	45.000	7.500	30.000	18.000	0
24	Tb. Nibung	100.000	60.000	0	30.000	14.000	0
25	S. Ulak	100.000	30.200	4.800	30.000	12.600	2.400
26	P. Kengas	100.000	15.000	15.000	30.000	12.000	3.000
27	Buku Tanjung	100.000	75.000	0	30.000	12.000	0
28	Mentawak	100.000	60.000	2.000	30.000	12.000	4.000
29	Tb. baru	50.000	6.000	20.000	-	-	-
30	Aur Duri	100.000	28.000	0	30.000	6.000	0
Total		1.390.000	583.600	158.020	984.000	345.600	119.400

ANNEX 5

- Private nurseries survey : main results.

Tri à plat de l'enquête
C:\WINSTAT2\DONNEES\IGPM_W~1\NEW2\LAST_J~1\SURVEY1\DATA_T~1\SURVEY1.ENQ, le 31. 3.98 à 11:34

[KECAMATAN] - Kecamatan

	Effectif	% sur total	%sur répondants
Muara Bungo	5	16.7 %	16.7 %
Rimbo Bujang	6	20.0 %	20.0 %
Tebo Ulu	0	0.0 %	0.0 %
Jambi Luar Kota	11	36.7 %	36.7 %
Bangko	2	6.7 %	6.7 %
Palawan Singkut	3	10.0 %	10.0 %
Tabir	3	10.0 %	10.0 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[KABUPATEN] - Kabupaten

	Effectif	% sur total	%sur répondants
Batang Hari	11	36.7 %	36.7 %
Bungo Tebo	11	36.7 %	36.7 %
SARKO	8	26.7 %	26.7 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[VILLAGE] - village

	Effectif	% sur total	%sur répondants
Sungai Pinang	0	0.0 %	0.0 %
Tanjung menanti	1	3.3 %	3.3 %
Pematang Sapat	1	3.3 %	3.3 %
Wiroto Agung	3	10.0 %	10.0 %
Pulau Temiang	3	10.0 %	10.0 %
Pondok Medja	9	30.0 %	30.0 %
Mentawak	2	6.7 %	6.7 %
Sungei merah	2	6.7 %	6.7 %
Sumber Agung	3	10.0 %	10.0 %
Other	6	20.0 %	20.0 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

Tri à plat de l'enquête
C:\WINSTAT2\DONNEES\IGPM_W~1\NEW2\LAST_J~1\SURVEY1\DATA_T~1\SURVEY1.ENQ,
le 31. 3.98 à 11:34

[KECAMATAN] - Kecamatan

	Effectif	% sur total	%sur répondants
Muara Bungo	5	16.7 %	16.7 %
Rimbo Bunjang	6	20.0 %	20.0 %
Tebo ulu	0	0.0 %	0.0 %
Jambi luar Kota	11	36.7 %	36.7 %
Bangko	2	6.7 %	6.7 %
Palawan Singkut	3	10.0 %	10.0 %
Tabir	3	10.0 %	10.0 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[KABUPATEN] - Kabupaten

	Effectif	% sur total	%sur répondants
Bantang hari	11	36.7 %	36.7 %
Bungo tebo	11	36.7 %	36.7 %
SARKO	8	26.7 %	26.7 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[VILLAGE] - village

	Effectif	% sur total	%sur répondants
Sungai Pinang	0	0.0 %	0.0 %
Tanjung menanti	1	3.3 %	3.3 %
Pematang Sapat	1	3.3 %	3.3 %
Wirotc Agung	3	10.0 %	10.0 %
Pulau Temiang	3	10.0 %	10.0 %
Pondok Medja	9	30.0 %	30.0 %
Mentawak	2	6.7 %	6.7 %
Sungei merah	2	6.7 %	6.7 %
Sumber Agung	3	10.0 %	10.0 %
Other	6	20.0 %	20.0 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[VILLOTHER] - If other, please mention the name of the village

	Effectif	% sur total	%sur répondants
N'ont pas répondu	24	80.0 %	
Rubingin	0	0.0 %	0.0 %
Bukit Bal	1	3.3 %	16.7 %
Simpang B	2	6.7 %	33.3 %
Sepunggur	1	3.3 %	16.7 %
Rantau Pa	1	3.3 %	16.7 %
Bernai	1	3.3 %	16.7 %
Total	6/30 questionnaires, soit 20.0 % de réponse		

[OWNERNAME] - Nursery Owner's name

	Effectif	% sur total	%sur répondants
Rubingin	1	3.3 %	3.3 %
Rukun Set	1	3.3 %	3.3 %
Aritonang	1	3.3 %	3.3 %
Parsum	1	3.3 %	3.3 %
Saeran	1	3.3 %	3.3 %
Suyarto	1	3.3 %	3.3 %
Mursin Yu	1	3.3 %	3.3 %
Sumardi	1	3.3 %	3.3 %
Endang Na	1	3.3 %	3.3 %
Kasim	1	3.3 %	3.3 %
Suradi	1	3.3 %	3.3 %
Basiran	1	3.3 %	3.3 %
Buyung Ro	1	3.3 %	3.3 %
Damin	1	3.3 %	3.3 %
Suwarno	1	3.3 %	3.3 %
Akhmad Mu	1	3.3 %	3.3 %
Gunawan	1	3.3 %	3.3 %
Marjohan	1	3.3 %	3.3 %
Muslimin	1	3.3 %	3.3 %
Ir.Agus	1	3.3 %	3.3 %
Abu Bakar	1	3.3 %	3.3 %
Mukhalid	1	3.3 %	3.3 %
Muja	1	3.3 %	3.3 %
Sudaryo	1	3.3 %	3.3 %
Husin	1	3.3 %	3.3 %
Sariyadi	1	3.3 %	3.3 %
Kadiran	1	3.3 %	3.3 %
Yusnardi	1	3.3 %	3.3 %
Satap	1	3.3 %	3.3 %
Samiyo	1	3.3 %	3.3 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[ETHNIC] - Ethnic group

	Effectif	% sur total	%sur répondants
Dayak	0	0.0 %	0.0 %
Javanais	20	66.7 %	66.7 %
Malayu	3	10.0 %	10.0 %
Sunda	2	6.7 %	6.7 %
Balinais	0	0.0 %	0.0 %
Minang	3	10.0 %	10.0 %
Other	2	6.7 %	6.7 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[AGECHILD] - Age of the oldest one ?

years	Effectif	% sur total	%sur répondants
N'ont pas répondu	4	13.3 %	
de 4 à 4	1	3.3 %	3.8 %
de 5 à 11	7	23.3 %	26.9 %
de 12 à 18	7	23.3 %	26.9 %
de 19 à 25	3	10.0 %	11.5 %
de 26 à 32	4	13.3 %	15.4 %
de 33 à 39	3	10.0 %	11.5 %
de 40 à 46	1	3.3 %	3.8 %

Moyenne : 18.2 Ecart-Type : 11.5 Minimum : 4.0 Maximum : 46.0

[GETLAND] - How did you get the land for the budwood garden and the nursery ?

	Effectif	% sur total	%sur répondants
Inherited	0	0.0 %	0.0 %
Owned	18	60.0 %	60.0 %
Purchased	1	3.3 %	3.3 %
Rented	1	3.3 %	3.3 %
Sharecrop	0	0.0 %	0.0 %
borrowed with no cost	10	33.3 %	33.3 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[PURCHCOST] - If purchased, cost of the land

.000 rupiah	Effectif	% sur total	%sur répondants
de 0 à 94	28	93.3 %	93.3 %
de 95 à 195	0	0.0 %	0.0 %
de 196 à 296	0	0.0 %	0.0 %
de 297 à 397	1	3.3 %	3.3 %
de 398 à 498	0	0.0 %	0.0 %
de 499 à 599	0	0.0 %	0.0 %
de 600 à 700	1	3.3 %	3.3 %

Moyenne : 35.0 Ecart-Type : 138.5 Minimum : 0.0 Maximum : 700.0

[RENTCOST] - If rented, cost of the rent

.000 rupiah	Effectif	% sur total	%sur répondants
de 0 à 10	29	96.7 %	96.7 %
de 11 à 25	0	0.0 %	0.0 %
de 26 à 40	0	0.0 %	0.0 %
de 41 à 55	0	0.0 %	0.0 %
de 56 à 70	0	0.0 %	0.0 %
de 71 à 85	0	0.0 %	0.0 %
de 86 à 100	1	3.3 %	3.3 %

Moyenne : 3.3 Ecart-Type : 18.0 Minimum : 0.0 Maximum : 100.0

[SHARECOST] - If sharecrop, cost of the land

.000 rupiah	Effectif	% sur total	%sur répondants
de 0 à 0	30	100.0 %	100.0 %

Moyenne : 0.0 Ecart-Type : 0.0 Minimum : 0.0 Maximum : 0.0

[AGE] - Age of the owner

years	Effectif	% sur total	%sur répondants
de 21 à 23	2	6.7 %	6.7 %
de 24 à 32	6	20.0 %	20.0 %
de 33 à 41	10	33.3 %	33.3 %
de 42 à 50	6	20.0 %	20.0 %
de 51 à 59	2	6.7 %	6.7 %
de 60 à 68	3	10.0 %	10.0 %
de 69 à 77	1	3.3 %	3.3 %

Moyenne : 41.3 Ecart-Type : 12.7 Minimum : 21.0 Maximum : 77.0

[SEX] - Sex of the owner

	Effectif	% sur total	%sur répondants
Male	30	100.0 %	100.0 %
Female	0	0.0 %	0.0 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[MARITALSTT] - Marital status

	Effectif	% sur total	%sur répondants
Married	27	90.0 %	90.0 %
Single	3	10.0 %	10.0 %
Divorced	0	0.0 %	0.0 %
Widowed	0	0.0 %	0.0 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[CHILDREN] - Do you have children ?

	Effectif	% sur total	%sur répondants
yes	26	86.7 %	86.7 %
no	4	13.3 %	13.3 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[NUMBCHILD] - If yes, how many children do you have ?

child(ren)	Effectif	% sur total	%sur répondants
N'ont pas répondu	4	13.3 %	
de 1 à 2	9	30.0 %	34.6 %
de 3 à 4	9	30.0 %	34.6 %
de 5 à 6	3	10.0 %	11.5 %
de 7 à 8	0	0.0 %	0.0 %
de 9 à 10	5	16.7 %	19.2 %

Moyenne : 4.0 Ecart-Type : 2.9 Minimum : 1.0 Maximum : 10.0

[LANDST] - Physical land status (vegetation before slash & burn) for roostock nursery ?

	Effectif	% sur total	%sur répondants
Secondary forest	0	0.0 %	0.0 %
Bushland	17	56.7 %	56.7 %
Old rubber plantation	1	3.3 %	3.3 %
Alang alang	12	40.0 %	40.0 %
other	0	0.0 %	0.0 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[NUMBSTAFF] - How many staff work in the nursery ?

ersonns	Effectif	% sur total	%sur répondants
de 1 à 2	21	70.0 %	70.0 %
de 3 à 5	5	16.7 %	16.7 %
de 6 à 8	2	6.7 %	6.7 %
de 9 à 11	1	3.3 %	3.3 %
de 12 à 14	0	0.0 %	0.0 %
de 15 à 17	0	0.0 %	0.0 %
de 18 à 20	1	3.3 %	3.3 %

Moyenne : 3.0 Ecart-Type : 3.8 Minimum : 1.0 Maximum : 20.0

[NUMBFULL] - How many full time staff ?

personns	Effectif	% sur total	%sur répondants
0	3	10.0 %	10.0 %
1	14	46.7 %	46.7 %
2	7	23.3 %	23.3 %
3	1	3.3 %	3.3 %
4	2	6.7 %	6.7 %
5	1	3.3 %	3.3 %
6	2	6.7 %	6.7 %

Moyenne : 1.9 Ecart-Type : 1 6 Minimum : 0.0 Maximum : 6.0

[NUMBPART] - How many part time staff ?

personns	Effectif	% sur total	%sur répondants
de 0 à 2	27	90.0 %	90.0 %
de 3 à 5	1	3.3 %	3.3 %
de 6 à 8	0	0.0 %	0.0 %
de 9 à 11	0	0.0 %	0.0 %
de 12 à 14	0	0.0 %	0.0 %
de 15 à 17	0	0.0 %	0.0 %
de 18 à 20	2	6.7 %	6.7 %

Moyenne : 1.5 Ecart-Type : 5.0 Minimum : 0.0 Maximum : 20.0

[MANDPART] - If you have part time staff, total number of mandays per year ?

Aucune réponse

[WATERTYPE] - What type of water supply do you have ?

	Effectif	% sur total	%sur répondants
No water supply	0	0.0 %	0.0 %
River	2	6.7 %	6.7 %
Well	11	36.7 %	36.7 %
rely on rainfall only	16	53.3 %	53.3 %
Other	1	3.3 %	3.3 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[WATEROTHER] - If other, what type of water supply do you have ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	29	96.7 %	
swampy wa	1	3.3 %	100.0 %
Total	1/30 questionnaires, soit 3.3 % de réponse		

[WATERDIST] - How far is your water supply from the nursery ?

Aucune réponse

[BUDOWN] - BUDWOOD GARDEN
Do you have your own budwood garden ?

	Effectif	% sur total	%sur répondants
yes	10	33.3 %	33.3 %
no	20	66.7 %	66.7 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[BUDORIGIN] - If not, where do you get your budwood ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	6	20.0 %	
pribadi YANG LAIN	0	0.0 %	0.0 %
P2KP2	8	26.7 %	33.3 %
APBD 1 OR 2	0	0.0 %	0.0 %
BANDES	8	26.7 %	33.3 %
PSSP	0	0.0 %	0.0 %
TCSDP PROYEK	6	20.0 %	25.0 %
TCSDP KEBUN ENTRYS DESA	0	0.0 %	0.0 %
PRiBADI ORANG STAFF TCSDP	0	0.0 %	0 0 %
LAIN	2	6.7 %	8.3 %
Total	24/30 questionnaires, soit 80.0 % de réponse		

[BUDADD] - Do you intend to add some other clones to your budwood garden ?

	Effectif	% sur total	%sur répondants
yes	14	46.7 %	46.7 %
no	16	53.3 %	53.3 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

	Effectif	% sur total
PB 260	6	20.0
RRIC 100	2	6.7
BPM 1	7	23.3
RRIM 600	4	13.3
GT 1	4	13.3
BPM 24	3	10.0
PR 261	4	13.3
AVROS 2037	0	0.0
PR 300	1	3.3
RRIM 712	0	0.0
Other	0	0.0

[BUDORIGG] - Where can you get this IGPM ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	16	53.3 %	
Sembawa	3	10.0 %	21.4 %
did not k	2	6.7 %	14.3 %
P2KP2	1	3.3 %	7.1 %
ICRAF	1	3.3 %	7.1 %
FromPTP V	1	3.3 %	7.1 %
TCSDP P.T	1	3.3 %	7.1 %
from Semb	2	6.7 %	14.3 %
from TCSD	2	6.7 %	14.3 %
Disbun	0	0.0 %	0.0 %
from Disb	1	3.3 %	7.1 %
Total	14/30 questionnaires, soit 46.7 % de réponse		

[BUDCHOICE] - Why did you choose the clones you currently have in your budwood garden ?

	Effectif	% sur total	%sur répondants
Personnal choice	2	6.7 %	6.7 %
No other IGPM avalaible	16	53.3 %	53.3 %
Adviced by Disbun or official insti	8	26.7 %	26.7 %
Adviced by friends and relatives	0	0.0 %	0.0 %
Other	4	13.3 %	13.3 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[BUDCHOTHER] - If other, please mention

	Effectif	% sur total	%sur répondants
N'ont pas répondu	26	86.7 %	
productio	1	3.3 %	25.0 %
Adviced b	3	10.0 %	75.0 %
Total	4/30 questionnaires, soit 13.3 % de réponse		

[CLONEHEAR] - Did you hear about these clones before ?

	Effectif	% sur total	%sur répondants
yes	20	66.7 %	66.7 %
no	10	33.3 %	33.3 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[HEARFROM] - If yes, where from ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	10	33.3 %	
Friends and relatives	5	16.7 %	25.0 %
Official institution	14	46.7 %	70.0 %
Other	1	3.3 %	5.0 %
Total	20/30 questionnaires, soit 66.7 % de réponse		

OOFFINSTIT] - If official institution, which one ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	16	53.3 %	
PTP IV Pa	1	3.3 %	7.1 %
Nes PTP I	1	3.3 %	7.1 %
Disbun	5	16.7 %	35.7 %
NES-PTP I	1	3.3 %	7.1 %
P2KP2 sta	2	6.7 %	14.3 %
PTP VI Ri	1	3.3 %	7.1 %
TCSDP Sta	3	10.0 %	21.4 %
Total	14/30 questionnaires, soit 46.7 % de réponse		

[OTHERHEAR] - If other, please mention

	Effectif	% sur total	%sur répondants
de 0 à 0	30	100.0 %	100.0 %

Moyenne : 0.0 Ecart-Type : 0.0 Minimum : 0.0 Maximum : 0.0

[KNOWCHARAC] - Do you know their characteristics ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	10	33.3 %	
yes	15	50.0 %	75.0 %
no	5	16.7 %	25.0 %
Total	20/30 questionnaires, soit 66.7 % de réponse		

[WHICHCHARA] - If yes, which ones ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	15	50.0 %	
Production	5	16.7 %	33.3 %
Fast growth	9	30.0 %	60.0 %
Resistance to diseases	0	0.0 %	0.0 %
Other	1	3.3 %	6.7 %
Total	15/30 questionnaires, soit 50.0 % de réponse		

[OTHERCHARA] - If other, please mention

	Effectif	% sur total	%sur répondants
N'ont pas répondu	27	90.0 %	
resistanc	2	6.7 %	66.7 %
daun bula	1	3.3 %	33.3 %
Total	3/30 questionnaires, soit 10.0 % de réponse		

[INFORIGIN] - How did you get informations about clones ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	16	53.3 %	
Friends and relatives	2	6.7 %	14.3 %
Official institution	12	40.0 %	85.7 %
Other	0	0.0 %	0.0 %
Total	14/30 questionnaires, soit 46.7 % de réponse		

[OTHERINFO] - If other, please mention

	Effectif	% sur total	%sur répondants
de 0 à 0	30	100.0 %	100.0 %

Moyenne : 0.0 Ecart-Type : 0.0 Minimum : 0.0 Maximum : 0.0

[CLONEKNOW] - How do you know that your planting material is that particular clone ?

	Effectif	% sur total	%sur répondants
You know you can recognize it	30	100.0 %	100.0 %
Guaranted by Disbun or official ins	0	0.0 %	0.0 %
Other	0	0.0 %	0.0 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[OTHERKNOW] - If other, please mention

	Effectif	% sur total	%sur répondants
de 0 à 0	30	100.0 %	100.0 %

Moyenne : 0.0 Ecart-Type : 0.0 Minimum : 0.0 Maximum : 0.0

[SEEDIFF] - Do you sometimes see differences in one plot for the same clone ?

	Effectif	% sur total	%sur répondants
yes	16	53.3 %	53.3 %
no	14	46.7 %	46.7 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[PURIFYPLOT] - Do you make a selection to purify the plot ?

	Effectif	% sur total	%sur répondants
yes	3	10.0 %	10.0 %
no	27	90.0 %	90.0 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[PURIFYHOW] - If yes, how ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	27	90.0 % ←	
~~took the~~ removed	3	10.0 %	100.0 %
Total	3/30 questionnaires, soit 10.0 % de réponse		

[WHYCLONE] - Do you know why there are so many clones ?

	Effectif	% sur total	%sur répondants
yes	1	3.3 %	3.3 %
no	29	96.7 %	96.7 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[CLONEADAPT] - Do you know if some clones are more adapted to the area than others ?

	Effectif	% sur total	%sur répondants
yes	26	86.7 %	86.7 %
no	4	13.3 %	13.3 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

	Effectif	% sur total
PB 260	0	0.0
RRIC 100	0	0.0
BPM 1	5	16.7
RRIM 600	1	3.3
GT 1	16	53.3
BPM 24	4	13.3
PR 261	4	13.3
AVROS 2037	1	3.3
PR 300	0	0.0
RRIM 712	0	0.0
Other	0	0.0

[HEARPCS] - Have you heard about clonal seedlings and polyclonal seedlings ?

	Effectif	% sur total	%sur répondants
yes	2	6.7 %	6.7 %
no	28	93.3 %	93.3 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[HEARFROMM] - If yes, where from ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	28	93.3 %	
BLIG (London Sumatra)	1	3.3 %	50.0 %
PCS Sungei Putih	0	0.0 %	0.0 %
Disbun	0	0.0 %	0.0 %
Other	1	3.3 %	50.0 %
Total	2/30 questionnaires, soit 6.7 % de réponse		

[WHEREBUY] - Where can you buy these planting materials ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	29	96.7 %	
PBIG Malaysia	1	3.3 %	100.0 %
Total	1/30 questionnaires, soit 3.3 % de réponse		

[PRICEPCS] - At what price ?

Aucune réponse

[DIIFPCS] - Do you think or do you know if there is a difference between clones, clonal (CS) and polyclonal (PCS) seedlings ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	28	93.3 %	
yes	2	6.7 %	100.0 %
no	0	0.0 %	0.0 %
Total	2/30 questionnaires, soit 6.7 % de réponse		

[WHICHDIFF] - If yes, which differences ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	25	83.3 %	
Growth	4	13.3 %	80.0 %
Production	1	3.3 %	20.0 %
Resistance to diseases	0	0.0 %	0.0 %
Total	5/30 questionnaires, soit 16.7 % de réponse		

[WHYADAPT] - Why are these clones more adapted ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	4	13.3 %	
Good grow	4	13.3 %	15.4 %
Can grow	6	20.0 %	23.1 %
Resistanc	1	3.3 %	3.8 %
good prod	4	13.3 %	15.4 %
suitable	9	30.0 %	34.6 %
big tree	1	3.3 %	3.8 %
productio	0	0.0 %	0.0 %
tolerance	1	3.4 %	3.8 %
Total	26/30 questionnaires, soit 86.7 % de réponse		

[CLONEMONO] - Do you know which clones are the best for monoculture ?

	Effectif	% sur total	%sur répondants
yes	27	90.0 %	90.0 %
no	3	10.0 %	10.0 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[LISTMONO] - If yes, which ones ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	3	10.0 %	
PB 260	2	6.7 %	7.4 %
RRIC 100	0	0.0 %	0.0 %
BPM 1	4	13.3 %	14.8 %
RRIM 600	0	0.0 %	0.0 %
GT 1	15	50.0 %	55.6 %
BPM 24	3	10.0 %	11.1 %
PR 261	3	10.0 %	11.1 %
AVROS 2037	0	0.0 %	0.0 %
PR 300	0	0.0 %	0.0 %
RRIM 712	0	0.0 %	0.0 %
Other	0	0.0 %	0.0 %
Total	27/30 questionnaires, soit 90.0 % de réponse		

[CLONERAS] - Do you know which clones are the best for Rubber Agroforestry Systems ?

	Effectif	% sur total	%sur répondants
yes	0	0.0 %	0.0 %
no	30	100.0 %	100.0 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

[BESTMAT] - Which rubber planting material is the best for you ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	22	73.3 %	
Clones	8	26.7 %	100.0 %
CS	0	0.0 %	0.0 %
PCS	0	0.0 %	0.0 %
Total	8/30 questionnaires, soit 26.7 % de réponse		

[WHYBEST] - Why ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	22	73.3 %	
Economical reasons	2	6.7 %	25.0 %
Technical reasons	0	0.0 %	0.0 %
Other reason	6	20.0 %	75.0 %
Total	8/30 questionnaires, soit 26.7 % de réponse		

[OTHERBEST] - If other reason, please mention

	Effectif	% sur total	%sur répondants
N'ont pas répondu	24	80.0 %	
Productio	5	16.7 %	83.3 %
pruductio	1	3.3 %	16.7 %
Total	6/30 questionnaires, soit 20.0 % de réponse		

[IGPMCLIENT] - Which type of IGPM do want you clients ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	24	80.0 %	
clone	6	20.0 %	100.0 %
Total	6/30 questionnaires, soit 20.0 % de réponse		

[SOILPREPBG] - WORKS AND CLEANING
Type of soil preparation for the budwood garden ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	14	46.7 %	
Tractor	0	0.0 %	0.0 %
Manual (cangkul)	16	53.3 %	100.0 %
Herbicide + direct holing	0	0.0 %	0.0 %
No land preparation	0	0.0 %	0.0 %
Other	0	0.0 %	0.0 %
Total	16/30 questionnaires, soit 53.3 % de réponse		

[USEFERTILI] - FERTILIZATION
Do you use fertilizers ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	15	50.0 %	
yes	6	20.0 %	40.0 %
no	9	30.0 %	60.0 %
Total	15/30 questionnaires, soit 50.0 % de réponse		

	Effectif	% sur total
Urea	6	20.0
SP 36	6	20.0
KCl	4	13.3
Other	0	0.0

[OTHERFERTI] - If other, please mention

	Effectif	% sur total	%sur répondants
de 0 à 0	30	100.0 %	100.0 %

Moyenne : 0.0 Ecart-Type : 0.0 Minimum : 0.0 Maximum : 0.0

[COSTUREA] - If urea, total cost for one year
Aucune réponse

[COSTSP] - If SP 36, total cost for one year
Aucune réponse

[COSTKCL] - If KCl, total cost for one year
Aucune réponse

[COSTOTHER] - If other, total cost for one year
Aucune réponse

[WEED] - WEEDING
Do you weed ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	15	50.0 %	
yes	9	30.0 %	60.0 %
no	6	20.0 %	40.0 %
Total	15/30 questionnaires, soit 50.0 % de réponse		

[WEEDTYPE] - If yes, type of weeding

	Effectif	% sur total	%sur répondants
N'ont pas répondu	21	70.0 %	
Mechanic	0	0.0 %	0.0 %
Chimical	1	3.3 %	11.1 %
Manual	8	26.7 %	88.9 %
Total	9/30 questionnaires, soit 30.0 % de réponse		

	Effectif	% sur total
Round up	0	0.0
Gramoxone	1	3.3
Polaris	0	0.0
Spark	0	0.0
Other	0	0.0

[WEEDOTHER] - If other, please mention

	Effectif	% sur total	%sur répondants
de 0 à 0	30	100.0 %	100.0 %

Moyenne : 0.0 Ecart-Type : 0.0 Minimum : 0.0 Maximum : 0.0

[WEEDFREQ] - Frequency of the weedigs ?

Aucune réponse

[WEEDLABOUR] - Labour required for total weeding ?

Aucune réponse

[WEEDCOST] - Cost of one manday ?

Aucune réponse

[DISEASE] - DISEASES

Do you face any problem with disease ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	15	50.0 %	
yes	1	3.3 %	6.7 %
no	14	46.7 %	93.3 %

Total 15/30 questionnaires, soit 50.0 % de réponse

	Effectif	% sur total
Colletotrichum (gugur daun)	1	3.3
Pink disease (jamur upas)	0	0.0
Fomes (akar putih)	0	0.0
oidium	0	0.0
other	0	0.0

[DISOTHER] - If other, what type of disease ?

	Effectif	% sur total	%sur répondants
de 0 à 0	30	100.0 %	100.0 %

Moyenne : 0.0 Ecart-Type : 0.0 Minimum : 0.0 Maximum : 0.0

[DISSTAGE] - At what stage in the budwood garden ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	29	96.7 %	
first whorl very young	1	3.3 %	100.0 %
medium stage of development	0	0.0 %	0.0 %
Other	0	0.0 %	0.0 %

Total 1/30 questionnaires, soit 3.3 % de réponse

[PESTICIDE] - Do you apply any pesticide ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	15	50.0 %	
yes	3	10.0 %	20.0 %
no	12	40.0 %	80.0 %

Total 15/30 questionnaires, soit 50.0 % de réponse

	Effectif	% sur total
Dithane M-45	3	10.0
Bayleton	0	0.0
Bayfidan	0	0.0
Trichoderma	0	0.0
Other	0	0.0

[PESTOTHER] - If other, please mention

	Effectif	% sur total	%sur répondants
de 0 à 0	30	100.0 %	100.0 %

Moyenne : 0.0 Ecart-Type : 0.0 Minimum : 0.0 Maximum : 0.0

[PESTNUMBER] - Number of treatments in 1996 ?

Aucune réponse

[PESTCOST] - Total cost of treatments in 1996 ?

Aucune réponse

[AREANURS] - NURSERY : Area of the nursery

ares	Effectif	% sur total	%sur répondants
de 10 à 64	24	80.0 %	80.0 %
de 65 à 120	4	13.3 %	13.3 %
de 121 à 176	1	3.3 %	3.3 %
de 177 à 232	0	0.0 %	0.0 %
de 233 à 288	0	0.0 %	0.0 %
de 289 à 344	0	0.0 %	0.0 %
de 345 à 400	1	3.3 %	3.3 %

Moyenne : 59.0 Ecart-Type : 70.8 Minimum : 10.0 Maximum : 400.0

	Effectif	% sur total
Jungle rubber seeds	3	10.0
Jungle rubber young plants	0	0.0
GT1 seeds	25	83.3
Young plants from GT1 seeds	3	10.0

[MATCOST] - Price of the planting material (seeds or plants) ?

rupiah per plant/seed	Effectif	% sur total	%sur répondants
de 0 à 1	12	40.0 %	40.0 %
de 2 à 5	6	20.0 %	20.0 %
de 6 à 9	4	13.3 %	13.3 %
de 10 à 13	7	23.3 %	23.3 %
de 14 à 17	0	0.0 %	0.0 %
de 18 à 21	0	0.0 %	0.0 %
de 22 à 25	1	3.3 %	3.3 %

Moyenne : 5.1 Ecart-Type : 5.5 Minimum : 0.0 Maximum : 25.0

[CRITERIA] - Criteria of choice for seeds vs young plants

	Effectif	% sur total	%sur répondants
N'ont pas répondu	1	3.3 %	
seeds GT1	1	3.3 %	3.4 %
From P2KP	2	6.7 %	6.9 %
seeds fro	3	10.0 %	10.3 %
big seeds	3	10.0 %	10.3 %
seeds fro	0	0.0 %	0.0 %
young plants	3	10.0 %	10.3 %
seeds fro	6	20.0 %	20.7 %
seeds fro	9	30.0 %	31.0 %
seeds fro	2	6.7 %	6.9 %
Total	29/30 questionnaires, soit 96.7 % de réponse		

[INTERROW] - Interrow distance in the nursery ?

centimeters	Effectif	% sur total	%sur répondants
de 25 à 34	1	3.3 %	3.3 %
de 35 à 45	11	36.7 %	36.7 %
de 46 à 56	13	43.3 %	43.3 %
de 57 à 67	4	13.3 %	13.3 %
de 68 à 78	0	0.0 %	0.0 %
de 79 à 89	0	0.0 %	0.0 %
de 90 à 100	1	3.3 %	3.3 %

Moyenne : 48.5 Ecart-Type : 12.3 Minimum : 25.0 Maximum : 100.0

[PLANDIST] - Planting distance on one row ?

centimeters	Effectif	% sur total	%sur répondants
de 10 à 10	5	16.7 %	16.7 %
de 11 à 15	3	10.0 %	10.0 %
de 16 à 20	10	33.3 %	33.3 %
de 21 à 25	5	16.7 %	16.7 %
de 26 à 30	6	20.0 %	20.0 %
de 31 à 35	0	0.0 %	0.0 %
de 36 à 40	1	3.3 %	3.3 %

Moyenne : 21.3 Ecart-Type : 7.4 Minimum : 10.0 Maximum : 40.0

	Effectif	% sur total
Tractor	1	3.3
Manual (cangkul)	29	96.7
Herbicide + direct holing	1	3.3
No land preparation	0	0.0
Other	0	0.0

[SOILOTHER] - If other, please mention

	Effectif	% sur total	%sur répondants
de 0 à 0	30	100.0 %	100.0 %

Moyenne : 0.0 Ecart-Type : 0.0 Minimum : 0.0 Maximum : 0.0

[USEFERTIL] - FERTILIZATION
Do you use fertilizers ?

	Effectif	% sur total	%sur répondants
yes	30	100.0 %	100.0 %
no	0	0.0 %	0.0 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

	Effectif	% sur total
Urea	30	100.0
SP 36	22	73.3
KCl	15	50.0
Other	2	6.7

[FERTIOTHER] - If other, please mention

	Effectif	% sur total	%sur répondants
N'ont pas répondu	28	93.3 %	
Kisrit	1	3.3 %	50.0 %
Gandasil	1	3.3 %	50.0 %
Total	2/30 questionnaires, soit 6.7 % de réponse		

[UREACOST] - If urea, total cost for one year

.000 rupiah	Effectif	% sur total	%sur répondants
de 0 à 12	4	13.3 %	13.3 %
de 13 à 30	20	66.7 %	66.7 %
de 31 à 48	3	10.0 %	10.0 %
de 49 à 66	1	3.3 %	3.3 %
de 67 à 84	1	3.3 %	3.3 %
de 85 à 102	0	0.0 %	0.0 %
de 103 à 120	1	3.3 %	3.3 %

Moyenne : 26.7 Ecart-Type : 22.6 Minimum : 0.0 Maximum : 120.0

[SPCOST] - If SP 36, total cost for one year

.000 rupiah	Effectif	% sur total	%sur répondants
N'ont pas répondu	8	26.7 %	
de 0 à 24	10	33.3 %	45.5 %
de 25 à 54	6	20.0 %	27.3 %
de 55 à 84	4	13.3 %	18.2 %
de 85 à 114	1	3.3 %	4.5 %
de 115 à 144	0	0.0 %	0.0 %
de 145 à 174	1	3.3 %	4.5 %

Moyenne : 39.7 Ecart-Type : 38.7 Minimum : 0.0 Maximum : 174.0

[KCLCOST] - If KCl, total cost for one year

.000 rupiah	Effectif	% sur total	%sur répondants
N'ont pas répondu	15	50.0 %	
de 4 à 15	6	20.0 %	40.0 %
de 16 à 30	4	13.3 %	26.7 %
de 31 à 45	0	0.0 %	0.0 %
de 46 à 60	4	13.3 %	26.7 %
de 61 à 75	1	3.3 %	6.7 %

Moyenne : 30.2 Ecart-Type : 21.2 Minimum : 4.0 Maximum : 75.0

[OTHERCOST] - If other, total cost for one year

Aucune réponse

[WEEDNU] - WEEDING

Do you weed ?

	Effectif	% sur total	%sur répondants
yes	27	90.0 %	90.0 %
no	3	10.0 %	10.0 %

Total 30/30 questionnaires, soit 100.0 % de réponse

	Effectif	% sur total
Mechanic	0	0.0
Chimical	4	13.3
Manual	27	90.0

[HERBNAMES] - If chimical, which herbicides do you use ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	26	86.7 %	
Round up	1	3.3 %	25.0 %
Gramoxone	0	0.0 %	0.0 %
Polaris	2	6.7 %	50.0 %
Spark	1	3.3 %	25.0 %
Other	0	0.0 %	0.0 %

Total 4/30 questionnaires, soit 13.3 % de réponse

[HERBOTHER] - If other, please mention

	Effectif	% sur total	%sur répondants
N'ont pas répondu	29	96.7 %	
Touchdown	1	3.3 %	100.0 %
Total	1/30 questionnaires, soit 3.3 % de réponse		

[FREQWEEDNU] - Frequency of the weedings from planting to grafting

Aucune réponse

[WEEDLABNU] - Labour required for total weeding ?

mandays	Effectif	% sur total	%sur répondants
N'ont pas répondu	3	10.0 %	
de 3 à 10	14	46.7 %	51.9 %
de 11 à 20	4	13.3 %	14.8 %
de 21 à 30	6	20.0 %	22.2 %
de 31 à 40	1	3.3 %	3.7 %
de 41 à 50	1	3.3 %	3.7 %
de 51 à 60	0	0.0 %	0.0 %
de 61 à 70	1	3.3 %	3.7 %

Moyenne : 16.2 Ecart-Type : 15.2 Minimum : 3.0 Maximum : 70.0

[COSTWEENU] - Cost of one manday ?

.000 rupiah	Effectif	% sur total	%sur répondants
N'ont pas répondu	3	10.0 %	
de 0 à 1	22	73.3 %	81.5 %
de 2 à 3	0	0.0 %	0.0 %
de 4 à 5	2	6.7 %	7.4 %
de 6 à 7	2	6.7 %	7.4 %
de 8 à 9	1	3.3 %	3.7 %

Moyenne : 1.1 Ecart-Type : 2.5 Minimum : 0.0 Maximum : 9.0

[PESTNU] - PESTICIDES

Do you apply any pesticide ?

	Effectif	% sur total	%sur répondants
yes	4	13.3 %	13 3 %
no	26	86.7 %	86.7 %
Total	30/30 questionnaires, soit 100.0 % de réponse		

	Effectif	% sur total
Dithane M-45	4	13.3
Bayleton	0	0.0
Bayfidan	0	0.0
Trichoderma	0	0.0
Other	0	0.0

[NUMBNU] - Number of treatments in 1996 ?

times per year	Effectif	% sur total	%sur répondants
N'ont pas répondu	26	86.7 %	
1	2	6.7 %	50.0 %
2	1	3.3 %	25.0 %
3	0	0.0 %	0.0 %
4	1	3.3 %	25.0 %

Moyenne : 2.0 Ecart-Type : 1.2 Minimum : 1.0 Maximum : 4.0

[COSTNU] - Total cost for treatment in 1996 ?

.000 rupiah	Effectif	% sur total	%sur répondants
N'ont pas répondu	26	86.7 %	
de 0 à 2	1	3.3 %	25.0 %
de 3 à 8	0	0.0 %	0.0 %
de 9 à 14	0	0.0 %	0.0 %
de 15 à 20	3	10.0 %	75.0 %

Moyenne : 13.8 Ecart-Type : 8.0 Minimum : 0.0 Maximum : 20.0

[FULLGRAFT] - GRAFTING
How many full time grafters do you have ?

full time grafters	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
de 1 à 2	17	56.7 %	60.7 %
de 3 à 4	9	30.0 %	32.1 %
de 5 à 6	0	0.0 %	0.0 %
de 7 à 8	0	0.0 %	0.0 %
de 9 à 10	2	6.7 %	7.1 %

Moyenne : 2.6 Ecart-Type : 2.3 Minimum : 1.0 Maximum : 10.0

[PARTGRAFT] - How many part time grafters do you have ?

part time grafters	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
de 0 à 0	23	76.7 %	82.1 %
de 1 à 2	3	10.0 %	10.7 %
de 3 à 4	1	3.3 %	3.6 %
de 5 à 6	0	0.0 %	0.0 %
de 7 à 8	0	0.0 %	0.0 %
de 9 à 10	1	3.3 %	3.6 %

Moyenne : 0.7 Ecart-Type : 2.0 Minimum : 0.0 Maximum : 10.0

[AVGRAFTIME] - Average working time per day for grafters during the grafting period ?

hours	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
de 2 à 3	7	23.3 %	25.0 %
de 4 à 5	6	20.0 %	21.4 %
de 6 à 7	10	33.3 %	35.7 %
de 8 à 9	5	16.7 %	17.9 %

Moyenne : 5.3 Ecart-Type : 1.9 Minimum : 2.0 Maximum : 9.0

[AVBUDGRAFT] - Average yield of the grafters per day (Number of buds per day) ?

buds per day	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
de 50 à 142	2	6.7 %	7.1 %
de 143 à 235	9	30.0 %	32.1 %
de 236 à 328	7	23.3 %	25.0 %
de 329 à 421	4	13.3 %	14.3 %
de 422 à 514	5	16.7 %	17.9 %
de 515 à 607	0	0.0 %	0.0 %
de 608 à 700	1	3.3 %	3.6 %

Moyenne : 307.1 Ecart-Type : 148.0 Minimum : 50.0 Maximum : 700.0

[LEARNGRAFT] - Where did you learn to graft ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	3	10.0 %	
PTP IV	1	3.3 %	3.7 %
From PTP	3	10.0 %	11.1 %
P2KP2	3	10.0 %	11.1 %
from frie	5	16.7 %	18.5 %
PTP VI Ri	4	13.3 %	14.8 %
TCSDP Sta	3	10.0 %	11.1 %
Disbun	6	20.0 %	22.2 %
From TCSD	1	3.3 %	3.7 %
from Disb	1	3.3 %	3.7 %
Total	27/30 questionnaires, soit 90.0 % de réponse		

[PAYGRAFT] - How do you pay your grafters ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	18	60.0 %	
Daily salary	0	0.0 %	0.0 %
By number of successfull grafted bu	12	40.0 %	100.0 %
Other	0	0.0 %	0.0 %
Total	12/30 questionnaires, soit 40.0 % de réponse		

[GRAFTPAY] - if grafters are on salary basis : how much der day ?

Aucune réponse

[BUDPAY] - If grafters are paid on a contract basis : how mich per successfull grafted bud

rp	Effectif	% sur total	%sur répondants
N'ont pas répondu	21	70.0 %	
de 40 à 52	4	13.3 %	44.4 %
de 53 à 68	3	10.0 %	33.3 %
de 69 à 84	1	3.3 %	11.1 %
de 85 à 100	1	3.3 %	11.1 %

Moyenne : 60.6 Ecart-Type : 16.7 Minimum : 40.0 Maximum : 100.0

[OTHERPAY] - If other, please mention

	Effectif	% sur total	%sur répondants
de 0 à 0	30	100.0 %	100.0 %

Moyenne : 0.0 Ecart-Type : 0.0 Minimum : 0.0 Maximum : 0.0

[AGEGRAF] - Age of the rootstock plants when grafted ?

months	Effectif	% sur total	%sur répondants
N'ont pas répondu	3	10.0 %	
3	1	3.3 %	3.7 %
4	0	0.0 %	0.0 %
5	4	13.3 %	14.8 %
6	9	30.0 %	33.3 %
7	6	20.0 %	22.2 %
8	1	3.3 %	3.7 %
9	6	20.0 %	22.2 %

Moyenne : 6.7 Ecart-Type : 1.5 Minimum : 3.0 Maximum : 9.0

[DIAMGRAF] - Diameter of graftable roostocks ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
Thin	6	20.0 %	21.4 %
Average	19	63.3 %	67.9 %
Normal	3	10.0 %	10.7 %
Total	28/30 questionnaires, soit 93.3 % de réponse		

[COSTPLASTI] - Cost of the plastic for the whole campaign ?

.000 rupiah	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
de 7 à 24	11	36.7 %	39.3 %
de 25 à 45	13	43.3 %	46.4 %
de 46 à 66	2	6.7 %	7.1 %
de 67 à 87	0	0.0 %	0.0 %
de 88 à 108	0	0.0 %	0.0 %
de 109 à 129	1	3.3 %	3.6 %
de 130 à 150	1	3.3 %	3.6 %

Moyenne : 35.9 Ecart-Type : 30.4 Minimum : 7.0 Maximum : 150.0

[CONTROL] - How long do you wait to control the success of grafting ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
Less than 3 weeks	17	56.7 %	60.7 %
3 weeks	9	30.0 %	32.1 %
More than 3 weeks	2	6.7 %	7.1 %
Total	28/30 questionnaires, soit 93.3 % de réponse		

[STAY] - How long do the plants stay in the nursery after the grafting ?

days	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
de 21 à 21	1	3.3 %	3.6 %
de 22 à 25	0	0.0 %	0.0 %
de 26 à 29	4	13.3 %	14.3 %
de 30 à 33	18	60.0 %	64.3 %
de 34 à 37	4	13.3 %	14.3 %
de 38 à 41	0	0.0 %	0.0 %
de 42 à 45	1 .	3.3 %	3.6 %

Moyenne : 30.5 Ecart-Type : 4.0 Minimum : 21.0 Maximum : 45.0

[STAGESELL] - SALES AND CLIENTS
If you produce polybags, at what stage do you sell them ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	4	13.3 %	
1 payung	22	73.3 %	84.6 %
2 payungs	2	6.7 %	7.7 %
3 payungs	0	0.0 %	0.0 %
Other	2	6.7 %	7.7 %
Total	26/30 questionnaires, soit 86.7 % de réponse		

[OTHERSTAGE] - If other, please mention

	Effectif	% sur total	%sur répondants
N'ont pas répondu	28	93.3 %	
stumps	2	6.7 %	100.0 %
Total	2/30 questionnaires, soit 6.7 % de réponse		

	Effectif	% sur total
Stumps	23	76.7
Polybags	24	80.0
Meters of budwood	0	0.0
Other	0	0.0

[OTHERIGPM] - If other, please mention

	Effectif	% sur total	%sur répondants
de 0 à 0	30	100.0 %	100.0 %

Moyenne : 0.0 Ecart-Type : 0.0 Minimum : 0.0 Maximum : 0.0

[COSTSTUMP] - Production cost for stumps ?
Aucune réponse

[COSTPOLY] - Production cost for polybags ?

rupiah	Effectif	% sur total	%sur répondants
N'ont pas répondu	6	20.0 %	
de 175 à 245	3	10.0 %	12.5 %
de 246 à 316	13	43.3 %	54.2 %
de 317 à 387	1	3.3 %	4.2 %
de 388 à 458	5	16.7 %	20.8 %
de 459 à 529	1	3.3 %	4.2 %
de 530 à 600	1	3.3 %	4.2 %

Moyenne : 320.2 Ecart-Type : 95.7 Minimum : 175.0 Maximum : 600.0

[COSTBUDWOO] - Production cost for meters of budwood ?

Aucune réponse

[COSSTOTHER] - Total Production cost for all IGPM ?

Aucune réponse

[PRICESTUMP] - Farm gate sale price for stumps ?

Aucune réponse

[PRICEPOLY] - Farm gate sale price for polybags ?

rupiah	Effectif	% sur total	%sur répondants
N'ont pas répondu	6	20.0 %	
de 500 à 630	8	26.7 %	33.3 %
de 631 à 764	10	33.3 %	41.7 %
de 765 à 898	5	16.7 %	20.8 %
de 899 à 1032	0	0.0 %	0.0 %
de 1033 à 1166	0	0.0 %	0.0 %
de 1167 à 1300	1	3.3 %	4.2 %

Moyenne : 693.8 Ecart-Type : 169.1 Minimum : 500.0 Maximum : 1300.0

[PRICEBUD] - Farm gate sale price for meters of budwood ?

Aucune réponse

[PRICEOTHER] - Farm gate sale price for other IGPM ?

Aucune réponse

	Effectif	% sur total
Estates	0	0.0
Farmers (< 5 ha)	26	86.7
Privates (> 5 ha)	0	0.0
Government projects	3	10.0
Others	3	10.0

[OTHERTYPE] - If others, please mention

	Effectif	% sur total	%sur répondants
N'ont pas répondu	27	90.0 %	
through b	3	10.0 %	100.0 %
trough bi	0	0.0 %	0.0 %
Total	3/30 questionnaires, soit 10.0 % de réponse		

[NUMBESTATE] - If estates, number of plants sold?

estates	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
0	27	90.0 %	96.4 %
1	0	0.0 %	0.0 %
2	1	3.3 %	3.6 %

Moyenne : 0.1 Ecart-Type : 0.4 Minimum : 0.0 Maximum : 2.0

[NUMBFARMER] - If farmers, number of plants sold?

farmers (<10)	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
de 0 à 10	10	33.3 %	35.7 %
de 11 à 25	13	43.3 %	46.4 %
de 26 à 40	2	6.7 %	7.1 %
de 41 à 55	2	6.7 %	7.1 %
de 56 à 70	0	0.0 %	0.0 %
de 71 à 85	0	0.0 %	0.0 %
de 86 à 100	1	3.3 %	3.6 %

Moyenne : 20.0 Ecart-Type : 20.0 Minimum : 0.0 Maximum : 100.0

[NUMBPRIVAT] - If privates, number of plants sold?

privates	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
de 0 à 0	28	93.3 %	100.0 %

Moyenne : 0.0 Ecart-Type : 0.0 Minimum : 0.0 Maximum : 0.0

[NUMBGOVPRO] - If government projects, number of plants sold?

projects	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
0	24	80.0 %	85.7 %
1	4	13.3 %	14.3 %

Moyenne : 0.1 Ecart-Type : 0.3 Minimum : 0.0 Maximum : 1.0

[NUMBMONO] - Number of farmers using IGPM in monoculture system ?

farmers	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
de 0 à 4	6	20.0 %	21.4 %
de 5 à 15	9	30.0 %	32.1 %
de 16 à 26	9	30.0 %	32.1 %
de 27 à 37	1	3.3 %	3.6 %
de 38 à 48	0	0.0 %	0.0 %
de 49 à 59	2	6.7 %	7.1 %
de 60 à 70	1	3.3 %	3.6 %

Moyenne : 17.2 Ecart-Type : 16.0 Minimum : 0.0 Maximum : 70.0

[NUMBAGROSY] - Number of farmers using IGPM in agroforestry systems ?

farmers	Effectif	% sur total	%sur répondants
N'ont pas répondu	3	10.0 %	
de 0 à 0	27	90.0 %	100.0 %

Moyenne : 0.0 Ecart-Type : 0.0 Minimum : 0.0 Maximum : 0.0

[TOTSALES] - Total number of plants sold in 1996 ?

plants	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
de 1000 à 15710	22	73.3 %	78.6 %
de 15711 à 30425	2	6.7 %	7.1 %
de 30426 à 45140	0	0.0 %	0.0 %
de 45141 à 59855	2	6.7 %	7.1 %
de 59856 à 74570	1	3.3 %	3.6 %
de 74571 à 89285	0	0.0 %	0.0 %
de 89286 à 104000	1	3.3 %	3.6 %

Moyenne : 16185.7 Ecart-Type : 23047.0 Minimum : 1000.0 Maximum : 104000.0

[TOTSTUMP] - Total number of stumps sold in 1996 ?

stumps	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
de 0 à 14284	23	76.7 %	82.1 %
de 14285 à 28570	1	3.3 %	3.6 %
de 28571 à 42856	2	6.7 %	7.1 %
de 42857 à 57142	1	3.3 %	3.6 %
de 57143 à 71428	0	0.0 %	0.0 %
de 71429 à 85714	0	0.0 %	0.0 %
de 85715 à 100000	1	3.3 %	3.6 %

Moyenne : 12035.7 Ecart-Type : 21252.7 Minimum : 0.0 Maximum : 100000.0

[TOTPOLY] - Total number of polybags sold in 1996 ?

polybags	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
de 0 à 2852	11	36.7 %	39.3 %
de 2853 à 5710	8	26.7 %	28.6 %
de 5711 à 8568	7	23.3 %	25.0 %
de 8569 à 11426	1	3.3 %	3.6 %
de 11427 à 14284	0	0.0 %	0.0 %
de 14285 à 17142	0	0.0 %	0.0 %
de 17143 à 20000	1	3.3 %	3.6 %

Moyenne : 4150.0 Ecart-Type : 4073.9 Minimum : 0.0 Maximum : 20000.0

[TOTMETERS] - Number of meters of budwood sold in 1996 ?

meters of budwood	Effectif	% sur total	%sur répondants
N'ont pas répondu	5	16.7 %	
de 0 à 0	25	83.3 %	100.0 %

Moyenne : 0.0 Ecart-Type : 0.0 Minimum : 0.0 Maximum : 0.0

[TOTSALRP] - Total amount of sales in 1996

.000 rupiah	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
de 300 à 3968	16	53.3 %	57.1 %
de 3969 à 7640	9	30.0 %	32.1 %
de 7641 à 11312	0	0.0 %	0.0 %
de 11313 à 14984	0	0.0 %	0.0 %
de 14985 à 18656	1	3.3 %	3.6 %
de 18657 à 22328	0	0.0 %	0.0 %
de 22329 à 26000	2	6.7 %	7.1 %

Moyenne : 5309.8 Ecart-Type : 6434.2 Minimum : 300.0 Maximum : 26000.0

[NUMBOTHER] - Number of farmers using other systems ?

farmers	Effectif	% sur total	%sur répondants
N'ont pas répondu	5	16.7 %	
de 0 à 0	25	83.3 %	100.0 %

Moyenne : 0.0 Ecart-Type : 0.0 Minimum : 0.0 Maximum : 0.0

[WAYKNOW] - How did you know your clients ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	3	10.0 %	
live in t	3	10.0 %	11.1 %
He knew t	16	53.3 %	59.3 %
talking w	4	13.3 %	14.8 %
Talking w	1	3.3 %	3.7 %
Talking w	2	6.7 %	7.4 %
Talking w	1	3.3 %	3.7 %
Total	27/30 questionnaires, soit 90.0 % de réponse		

[INTENDGAIN] - Do you intend to gain more clients ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
yes	24	80.0 %	85.7 %
no	4	13.3 %	14.3 %
Total	28/30 questionnaires, soit 93.3 % de réponse		

[WAYINTEND] - How do you intend to do so ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	5	16.7 %	
To get mo	12	40.0 %	48.0 %
for more	1	3.3 %	4.0 %
incease u	6	20.0 %	24.0 %
really gr	2	6.7 %	8.0 %
too old	1	3.3 %	4.0 %
get more	1	3.3 %	4.0 %
make nurs	2	6.7 %	8.0 %
Total	25/30 questionnaires, soit 83.3 % de réponse		

[BENEFIT] - Estimated benefit for 1996 ?

.000 rupiah	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
de 100 à 2574	19	63.3 %	67.9 %
de 2575 à 5055	6	20.0 %	21.4 %
de 5056 à 7536	0	0.0 %	0.0 %
de 7537 à 10017	1	3.3 %	3.6 %
de 10018 à 12498	0	0.0 %	0.0 %
de 12499 à 14979	0	0.0 %	0.0 %
de 14980 à 17460	2	6.7 %	7.1 %

Moyenne : 2883.6 Ecart-Type : 4024.0 Minimum : 100.0 Maximum : 17460.0

[INCREASE] - Do you intend to increase your production ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	2	6.7 %	
yes	24	80.0 %	85.7 %
no	4	13.3 %	14.3 %
Total	28/30 questionnaires, soit 93.3 % de réponse		

[WAYINCREAS] - How do you intend to do so ?

	Effectif	% sur total	%sur répondants
N'ont pas répondu	7	23.3 %	
To get mo	16	53.3 %	69.6 %
get more	5	16.7 %	21.7 %
make nurs	2	6.7 %	8.7 %
Total	23/30 questionnaires, soit 76.7 % de réponse		

ANNEX 6

- Preliminary survey of Jambi province in 1997, presented at SRAP workshop, September 1997.

IGPM Availability And Use In Jambi Province

Iwan Komardiwan and Eric Penot

Introduction

Jambi is one of the main rubber producing provinces of Indonesia. Total area of rubber fields is about 520,450 ha, and consists of 505,851 ha of smallholder rubber (Perkebunan rakyat), 6,725 ha of government plantations (Perkebunan negara/ PTP), and 7,874 ha Private plantations (Perkebunan Swasta). This data is taken from Laporan Tahunan. 1996 Dinas Perkebunan Dt.I Propinsi Jambi (Annual Report). However, this year the situation might change because there are many new private plantations planned, especially oil palm plantations. In Jambi province, three main rubber producing districts are Sarolangun Bangko about 215,618 ha, Bungo Tebo about 154,339 ha, and Batang Hari about 147,835 ha in 1996. The other districts, in which there is rubber production (on a smaller scale) are Tanjung Jabung and Kerinci. Therefore, this study was carried out in the districts of Bungo Tebo, Batang Hari, and Sarolangun Bangko. Due to lack of time in Sarolangun Bangko, just the secondary data was collected. The study was carried out in December 1995 and two weeks in May 1997. The total survey time was about six weeks.

The aim of the study was to investigate the availability and use of rubber clones/IGPM (Improved Genetic Planting Material) in Jambi province.

Survey Methods

The study was a descriptive survey, collecting both secondary and primary data. Secondary data was taken from Dinas Perkebunan (Plantations Departement) Dt.I propinsi Jambi, TCSDP (Tree Crops Smallholder Development Project) office in Jambi, and Dinas Perkebunan in every district. The primary data was collected through inspection of government and private rubber nurseries and open interviews with their staff.

Outputs

IGPM availability depends on the distribution of clone nurseries and on the type of IGPM produced. The production of clones in Jambi province is the following :

a. Government projects of clone nurseries
b. Specific Project : 1 Private company in cooperation with Gapkindo Jambi and CPIS
c. Farmers' clone nurseries (private)

a. Government projects of clone nurseries

The dispersal of clones in Jambi province and its districts began with the TCSDP (Tree Crops Smallholder Development Project). This project started in 1986 with budwood gardens and rootstock nurseries. TCSDP established these gardens in different districts depending on the potential for rubber plantation in each district. The development of these gardens can be seen in the following tables.

Table 1. TCSDP budwood gardens in Jambi province

District	UPP	Area	Number of trees per clone								Year
		(ha)	BPM-1	BPM-24	GT-1	PR-255	PR-261	PR-300	PR-303	PR-228	planted
Batang	Ma.Bulian	-	-	-	-	-	-	-	-	-	-
Hari	Ma.Tembesi	7	7650	22400	-	-	18500	-	-	-	1991/92
Bungo	Ma.Tebo	6	-	-	45644	-	-	-	-	-	1987/88
Tebo	P.Temiang	5	8124	11386	-	-	11707	-	-	-	1987/88
Saro-	Sarolangun	4	-	7500	550	-	9478	-	765	-	1991/92
langun	Pauh	4	653	9682	-	-	3665	-	-	-	1991/92
Bangko	Singkut	5	-	-	32258	1419	1412	1428	1321	1422	1986/87
	Total	31	16427	50968	78452	1419	44762	1428	2086	1422	

Source : Laporan UPP, Bagian Proyek TCSDP Jambi 1996

Besides establishing budwood gardens, TCSDP also developed rootstock gardens in the same year, as can be seen in this table.

Table 2. TCSDP rootstock nurseries in Jambi province

Districts	**UPP**	**Area (ha)**	**Year Planted**	**Comment**
Batang Hari	Muara Bulian	15	1991/1992	All the GT 1 seeds for each UPP
	Muara Tembesi	5	1991/1992	are bought from Sembawa area
Bungo Tebo	Muara Tebo	15	1987/1988	
	Pulau Temiang	15	1987/1988	
Sarolangun Bangko	Sarolangun	8	1991/1992	
	Pauh	7	1991/1992	

Source : Laporan Tahunan TCSDP 1992/1993 (Annual Report)

143

The first budwood garden (Table 1) and rootstock nursery were in Singkut, all the stumps and GT 1 seeds were bought from Sembawa area. For the other UPP nurseries, stumps were bought from Sungai Putih Medan, especially BPM-1 and BPM-24, and the other stumps were taken from UPP Singkut.
There was no information about annual grafted stump production, however up to 1996, TCSDP succeeded establishing about 20,787 ha of clonal rubber plantations, with 20,360 Smallholder participants in Jambi province.

The other programs (besides TCSDP) mainly focused on budwood production through the establishment of budwood gardens for local communities. Details of several government projects, can be seen in the following table.

Table 3. Dinas Perkebunan nursery projects in Jambi province

No	Project name	Area (ha)	Year planted
1	PSP2	6	1994/1995
2	APBD Tk.I	1	1991/1992
3	APBD Tk.II	0.25	1991/1992
4	P2KP2	0.20	1990/1991
5	INPRES-BANDES	49.21	1992/1993

Source : Laporan Tahunan Dinas Perkebunan Dt.I Jambi, 1996.

There is no information about annual grafted stumps production. It is necessary to know how many ha of clonal rubber plantations were developed through these projects. At this time, the only available information in Bungo Tebo is that there is 2,179 ha of smallholder clonal rubber plantation through the INPRES-BANDES Project, and in Batang Hari 2,537 ha from the same project. Of the INPRES-BANDES programme, only a few budwood gardens have been efficiently used by local farmers. A further survey is necessary to explain the very low level of adoption by farmers. Subsequently, a very small amount of improved planting material has been produced by farmers. This shows that the presence of a budwood garden is necessary, but not sufficient in itself to boost IGPM production.

b. Specific Project : The Gapkindo/CPIS nursery program

In 1993 Gapkindo, PT. Brahma Bina Bakti, and CPIS (Center for Policy and Implementation Studies) cooperated the 'Dispersed Rubber Development Pilot Project'. Their activity focused on budwood garden and rootstock nursery development for extension of smallholder plantations.

In the first year of their cooperation, about 1 ha of budwood garden and rootstock nursery were established at PT. Brahma Bina Bakti Plantation (53 km from Jambi on the road to Merlung). They bought the stumps and GT-1 seeds from PT.Virco in Padang Sidempuan. Stumps were checked and produced by PT. Virco from material originally coming from Sungai Putih Research Station. The condition of the budwood garden and rootstock nursery can be seen in these tables.

Table 4. Condition of budwood garden

Clone	*No. trees Planted on 28-08-1993*	*No. trees growing on 23-08-1994*	*Percentage survival*
RRIC-100	2,273	2,135	93.9
PR-261	9,590	2,785	29.0
BPM-1	5,126	2,535	49.5
BPM-24	4,716	2,501	53.0

Source : Laporan Peninjauan Kebun Bibit oleh Staf Gapkindo, Agustus 1994

Table 5. Condition of rootstock nursery

Block code	**No. trees Planted on 23-01-1994**	**No. trees growing on 23-08-1994**	**Percentage survival**
A.23	22,576	16,451	72.9
A.24	24,904	20,158	80.9
A.25	23,998	15,081	62.8
A.26	22,576	15,166	67.2
Total	94,054	66,856	71

Source : Laporan Peninjauan Kebun Bibit, Gapkindo, August 1994

Besides the location at PT. Brahma Bina Bakti, the project also built rootstock nurseries with farmers (as a satellite project) and can be seen in this table .

Table 6. Condition of farmers rootstock nurseries

Block Code	Farmers name	No. trees Planted on January 1994	No. trees growing on 23-08-1994	Percentage survival
I	M.Syukri	25,000	18,548	74
II	Syaroni	25,000	18,547	74
III	Abdul Mutalib	25,000	18,547	74
Total		75,000	55,642	74

Source : Laporan Peninjauan Bibit, Gapkindo, August 1994

From the three tables, it can be seen that in the budwood garden there was a very low percentage survival, and there was no information about the reason why. However, we can see there was a big potential for producing a high number of grafted stumps and eventually establishing a large number of clonal rubber smallholder plantations, but unfortunately there were no more reports or follow up from Gapkindo, nor from PT.Brahma Bina Bakti.
We received informal reports that the rootstocks were not grafted because they were used by farmers for seedling rubber plantations. The budwood garden was thinned to become a productive rubber plantation.

Although the IGPM production system established by Gapkindo/ CPIS and PT.Brahma Bina Bakti was originally well planned, this experience shows that IGPM production and dissemination at the farmers' level is not an easy task and achievement of such objectives are highly dependent on suitable training and efficient follow up of activities. Small size private nurseries and self production of planting material by farmers (for instance well managed community village budwood gardens with relevant training) seem to be more suited to the objective of IGPM dissemination.

c. Farmers clone nurseries

As was seen before, IGPM was first dispersed through the government clonal rubber nurseries and then was followed by surrounding farmers. They tried to make grafted stumps, partly for their own plantations, and partly for sale. They obtained the budwood from unmanaged or abandoned government nurseries. This activity is still going on at the present time. This activity has largely contributed to clonal rubber availability in areas where budwood gardens were established in Jambi province.

1996	8	43,750	350,000	200
	8	11,562	92,500	700

Source : Results from interviews, May 1996, SRAP.

From both tables it can be seen that the greatest production from farmers nurseries is grafted stumps (Okulasi mata tidur), rather than polybags. This might be because the price of stumps is lower than that of polybags (see Table 7). The types of clones available are similar to that of the government nurseries. Clones in Bungo Tebo are BPM-1, BPM-24, and GT-1. In Batang Hari they are GT-1, PR-261, and PR-300.

However, farmers sold stumps as a mixture of clones. The farmers are not sensitive to clonal purity, reflecting the lack of information both from producers and users (farmers).

Conclusions

IGPM availability and use in Jambi province first began through government projects such as TCSDP, PSP2, P2KP2, and INPRES-BANDES, and then was followed by the establishment of individual private nurseries. Improvement of farmers capabilities is a priority, especially for establishment and management of budwood gardens. Nowadays the farmers prepare rootstock nurseries by collecting budwood from existing (generally abandoned) budwood gardens.

Farmers might have access to budwood gardens, especially community budwood gardens established by the BANDES programme. However, lack of training, poor management, lack of relevant technical information and social coherence of communities are currently the main constraints faced by farmers that limit their potential to produce IGPM. Although other types of planting material might be available for rubber, emphasis is put on clones. Clones are high yielding, very homogenous, and have better secondary characteristics than clonal or polyclonal seedlings. In Table 9, we present the most suitable clones for the area; selected by SRAP, in particular for agroforestry systems.

Both the private nursery sector and IGPM production by farmers themselves should be developed and sustained. This raises the problem of access to good quality budwood gardens, clonal purity, and certification of IGPM, as well as correct and adapted recommendations for clone use in the province.

It still necessary to complete this survey, especially with further information about government projects through Dinas Perkebunan. Getting information is sometimes difficult because of the bureaucracy. It is also necessary to interview the farmers who have nurseries in Sarolangun Bangko .

The condition of farmers' nurseries are shown in Table 7 and Table 8.

Table 7. Farmers' clone nursery production in Bungo Tebo

Year	No. of farmers selling stumps/ polybags	Average production of stumps/ polybags	Total Production stumps/ polybags	Price (Rp) per stump/ polybag
1991	4	10,500	42,000	175
	2	3,000	6,000	650
1992	4	10,500	42,000	175
	2	3,000	6,000	650
1993	4	10,500	42,000	175
	2	3,000	6,000	650
1994	5	10,800	54,000	200
	4	3,000	12,000	700
1995	7	11,000	77,000	250
	5	3,800	19,000	750
1996	7	12,430	87,000	250
	6	3,830	23,000	750

Source : Results from interviews, May 1996, SRAP.

Table 8. Farmers' clone nursery production in Batang Hari

Year	No. of farmers selling stumps/ polybags	Average production of stumps/ polybags	Total production stumps/ polybags	Price (Rp) per stump/ polybag
1988	2	7,750	15,500	125
	-	-	-	-
1989	2	10,250	20,500	100
	-	-	-	-
1990	4	14,375	57,500	100
	1	2,000	2,000	400
1991	4	27,250	109,000	125
	1	2,000	2,000	450
1992	6	31,665	190,000	130
	1	2,000	2,000	500
	6	41,666	250,000	150
1993	4	13,750	55,000	550
1994	7	47,857	335,000	150
	7	31,071	217,500	600
1995	8	32,750	262,000	175
	7	18,500	129,500	650

ANNEX 8

Clones characteristics

Clone file n 1 : BPM 1

I. PRESENTATION

- Parents : AVROS 163 x AVROS 308

- Geographical origin : North-Sumatra, Medan, Indonesia
From AVROS, released in 1950.

- Recommendations : Malaysia class III
Indonesia class I
Thailand class III
Côte d'Ivoire : not available

- Available from : Indonesia, Malaysia, Thailand, Côte d'Ivoire.
BPM 1 contributes to 1,2 % of estates planted area in Indonesia.

II. MORPHOLOGICAL OBSERVATIONS

- Appearance in budwood garden: see description file in annex

- Trunk

Straight and regular.

- bark

The bark is good and easily tapped and its surface is not smooth. BPM 1 may be considered for smallholders. The bark thickness is average and quite soft for tapping. The bark renewing is average and the resistancy to woundings seems to be good.

- branch aspect

Candelar type and medium size.

- Canopy

Conical type with a medium size. Good shading. The crown is heavy. Early defoliation in South-Sumatra.

III. AGRONOMY

- Seed production time

Early.

- Grafting - bud emergence

Grafting sucess is average.

- Immature growth (in cm, at 1 metre high)
in Indonesia

In Indonesia : North-Sumatra :

YEAR	2	3	4	5
BPM 1	24,6	37	48	54,9
GT 1	21,5	33,1	45,7	51,6

Limah Puluh Estate, Socfindo, 1985

The growth of BPM 1 is good and remains good after opening. Opening occurs at the age of 5 years.

- Growth after opening

Good

- Production

- At large scale in Indonesia (kg/ha/year) (source : IRRI, 1990)

Commercial block planting in North-Sumatra :

YEAR	1	2	3	4	5
BPM 1					
Kg/ha/year	739	1050	1449	1520	1700
Cumulated	739	1789	3238	4758	6458
GT1					
Kg/ha/year	742	879	1289	1494	1477
Cumulated	742	1621	2910	4404	5881

YEAR	6	7	8	9	10
BPM 1					
Kg/ha/year	1879	2260	2351	2487	
Cumulated	8337	10597	12948	15435	
GT 1					
Kg/ha/year	1733	2053	2162	2163	1874
Cumulated	7614	9667	11829	13992	15866

BPM 1 has a very good production, slightly above GT 1 in the first years but keep the same production increase after 5 years. The same level of production during wintering is maintained.

- At large scale in commercial planting block in North-Sumatra :
1974 International clones exchange in Dolok Ulu

YEAR	1	2	3	4	5
BPM 1	1074	1581	1855	1653	2731
Cumulated	1074	2655	4510	6163	8894
GT 1	659	1040	1248	1277	1938
Cumulated	659	1699	2947	4224	6162

(Dolok Ulu Estate)
1974 International clone exchange trial.

YEAR	6	7	8	MEAN	% of GT 1
BPM 1	2917	2756	2487	2132	124
Cumulated	11811	14657	17054		
GT 1	2472	2691	2440	1718	100
Cumulated	8634	11325	13765		

- at large scale in North-Sumatra :

Sei Rumbia estate :

year	1	2	3	4	5	6	7	mean	% / GT 1
BPM 1									
kg/ha	955	1263	1598	1787	1731	2093	2093	1646	
Culumated	955	2218	3816	5603	7334	9427	11520		84 %
in g/t/t	22,3	29,2	37,1	41,4	39	50	48,2	38,2	
GT 1									
kg/ha	788	1371	1881	2466	2315	2442	2527	1970	
Cumulated	788	2159	4040	6506	8821	11263	13790		
in g/t/t	16,7	29,4	40,2	51,9	47,5	49,5	52,6	41,1	

- Physiology

Not well known. In Indonesia, a low response to stimulation is observed.

- Exploitation system

1/2 S D/2 commonly in Indonesia.

SECONDARY CHARACTERISTICS

- Wind damage susceptibility

Low in Indonesia.

- Tapping Panel Dryness susceptibility (TPD)

Average

- Leaf diseases susceptibility

BPM 1 is generally considered resistant to main leaf diseases : *Colletotrichum* and *Corynespora* in Indonesia.
Average resistancy to Oidium, *Phytophtora* and pink disease.

V. TECHNOLOGY

(From Sungei Putih if not mentionned)

DRC : 34-38

- Rubber from latex

. Initial colour (latex)	: yellowish ; 4,6
. Final colour	:
. Ph	: 5,73
. Stabilized Mooney viscosity	: 78
. Rate of cure	:
. Po	: 49
. N2	:
. P	: 0,14
. Mg	: 0,038
. scorch	:

- Rubber from cup-lump

. Stabilized Mooney viscosity	:
. Rate of cure	:
. PRI	: 92

- Centrifuged latex

. Mechanical stability (MST)	:
. Volatile fatty acid content (VFA)	:
. Potassium index (KOH)	:

VI. RECOMMENDATIONS

BPM 1 is high yielding clone a very good growth, probably amongst the best clones released by IRRI. It is considered very promising.
This clone is recommended in Indonesia by IRRI, in particular as a challenge for BPM 24 in zones suffering from *Colletotrichum,* such as West-Kalimantan province.

Clone file n 2 : PB 260

I. PRESENTATION

- Parents	:	PB 5/51 x PB 49
- Geographical origin	:	Malaysia (Prang besar)
- Recommendations	:	Malaysia class I Indonesia class II India class III Thailand class II Côte d'Ivoire classe IIa
- Available from	:	Southeast Asia, Africa.

II. MORPHOLOGICAL OBSERVATIONS

- Appearance in budwood garden: see description file in annex

- Trunk

Straight, vertical and regular.

- bark

Average. Poor renewing in Indonesia. Susceptible to woundings.

- branch aspect

Many light plagiotropic branches, comparable to PB 5/51. The frame of the tree is well distributed between the the main stem and the light branches. Lower branches are self-pruning.

- Canopy

Oval shape, well balanced, lower than that of PB 235. Dense in the first years, then more light with a tendancy to grow high, when growing older.

III. AGRONOMY

- Seed production time

Flowering appears on very young trees and pollinisation is successful with this female clone. PB 260 has a very good seed production. The use of P 260 seedlings as rootstock is still not very well known.

- Grafting - bud emergence

Satisfactory

- Immature growth (in cm, 1 metre high above ground level)

In Indonesia : North-Sumatra : stump :

YEAR	2	3	4	5	6
AVROS 2037	10,3	23,6	36	46	51
PB 260	11	22,6	36	44,8	50,9

Simalungun district, 1986

In Indonesia : North-Sumatra : polybag

YEAR	2	3	4	5
PB 260	23,1	37,7	45,7	55,6
GT 1	21,5	33,1	45,7	51,6

Limah Puluh Estate, Socfindo, 1985

In RCI

YEAR	2	3	4	5
PB 260	15,8	25,7	37,5	46,4
GT 1	15,3	23,2	33,8	42,2

Growth before opening is average to good. Opening occurs at 5 years old.
The growth is considered as good, above average but similar to AVROS 2037.
In North-Sumatra, growth is similar to that of AVROS 2O37, but above that of GT 1.

- Growth after opening

Average.

- Production

PB 260 is considered a very high yielding clone in Malaysia and Indonesia. Its level of production is comparable to that of PB 235. The response to stimulation is average to good.

- At large scale in commercial planting block in North-Sumatra : in kg/ha

In 2 estates in North-sumatra :

YEAR	1	2	3	4	5	Cumulated
PB 260 Namu tongan estate, 15 ha	640	1649	1316	1332	1623	6560
PB 260 Bungara estate, 60 ha	504	1213	1830	1738	1987	7272
PR 261 Bungara, 27 ha	337	885	1081	1252	1495	5050
GT 1 Bungara, 28 ha	564	732	1113	1474	1265	5148

First year of production : 1989.

PB 260 has a production 27 to 41 % above that of GT 1, and 30 to 44 % above that of PR 261 for the first 5 years of production in North-Sumatra.

- At large scale in commercial planting block in North-Sumatra :

Commercial block planting : North-Sumatra : Begerpang estate

YEAR	1	2	3	4	5	% / RRIM 600
PB 235 13 ha	688	1464	1975	1521	1550	122
PB 260 13 ha	718	1909	2275	2269	2253	159
RRIM 600 13 ha	262	612	1198	1551	2297	

Year of production : 1989, planted in 1984.

PB 260 has a production 59 % above that of RRIM 600 for the first 5 years of production in North-Sumatra. Its level of production is superior to that of PB 235 in the same conditions.

Commercial block planting : North-Sumatra : Sei Rumbyia estate

YEAR	1	2	3	4	5	% / RRIM 600
PB 235 13 ha	541	763	1794	1679	1925	127 %
PB 260 13 ha	444	1008	1627	1916	1913	131 %
GT 1 13 ha	256	637	1166	1624	1599	

Year of production : 1989, planted in 1984.

PB 260 has a production 31 % above that of GT 1 for the first 5 years of production in North-Sumatra. Its level of production is very close to that of PB 235 in the same conditions.

- ***At large scale in in Malaysia (kg/ha/year)***

Source: Planters' bulletin RRIM n 198 - 1989

YEAR	1	2	3	4	5
PB 260					
Kg/ha/year	1180	1820	2220	2220	1960
Cumulated	1180	3000	5220	7440	9400
GT1					
Kg/ha/year	742	879	1289	1494	1477
Cumulated	742	1621	2910	4404	5881

YEAR	6	7	8	9	10
PB 260					
Kg/ha/year	2370	2760	2530	2390	2230
Cumulated	11770	14530	17060	19450	21680
GT 1					
Kg/ha/year	1733	2053	2162	2163	1874
Cumulated	7614	9667	11829	13992	15866

PB 260 is one of the most yielding clone available in Indonesia. Good level of production during wintering.

In North-Sumatra, opening occurs at 4 years old (Pt Goodyear, SOCFIN.....) with 1/2 S D/3 6d/7, ELS 2,5 %. Prduction level is 27 to 28 % above that of AVROS 2037 during the fist 3 years and 30 % above PR 255. It seems that observations in Malaysia show that production is slightly declining on renewed bark.

- ***2) In large scale in Côte d'Ivoire*** (Source : Fichier Clones CIRAD-CP)

YEAR	1	2	3	4	5
PB 260					
g/t/t	36,0	62,5	65,8	46,8	
kg/ha/year	1184	2181	2266	2086	
kg/ha cumulated		3365	5631	7717	
GT 1					
g/t/t	30,5	35,4	34,9		
kg/ha/year	931	1414	1606		
kg/ha cumulated		2345	3951		

- Physiology

The physiological profile of PB 260 is comparable to that of PB 235. Its metabolism is very active, explaining the high level of production soon after opening, but low sucrose levels certainly show that its fragility. PB 260 is considered very susceptible to TPD in Malaysia.

- Exploitation system

It is recommended to use a very low intensive exploitation system, due to its active metabolism. Recommended exploitation systems with stimulation are similar to those of PB 235.

IV. SECONDARY CHARACTERISTICS

- Wind damage susceptibility

Considered satisfying, some wind damage may be recorded with strong storms. Moderate susceptibility in North-Sumatra in estates.

- Tapping Panel Dryness susceptibility (TPD)

PB 260 is very susceptible to TPD, as much as PB 235, if not more so in Africa. Recorded as average in Indonesia and few incidence in estates in North-Sumatra.

- Leaf diseases susceptibility

No particular susceptibility to *Colletotrichum*, and considered resistant in Cameroon (in La Nyété estate) and in Indonesia.

PB 260 is very susceptible to *Corynespora* in Cameroon since 1989. However it is noted as tolerant in Indonesia, attention should be put to that susceptibility, in particular in West-Kalimantan, where PB 260 appears as the best alternative to GT 1 in estates and is widely planted.
Very susceptible to *Microcyclus ulei* in french Guyana.

PB 260 is reported as having a correct tolarenace to leaf diseases.

Moderately susceptible to Oidium and lump cancer.

- Tapping panel

The thin bark, inferior to average, before opening, has a low quality of regeneration. PB 260 may be susceptible to *Phytophtota sp* panel disease.

- Wood production :

Wood production at the end of the economic lifespan is between 0,72 to 1,19 m3 per tree.

V. TECHNOLOGY
(RRIM)

DRC : 38-41

- Rubber from latex

. Initial colour (latex) : < 6 (lovibond)
. Final colour : pale
. Stabilized Mooney viscosity : average (60, 63 for RRIM)
. Rate of cure : average to fast : 7,3
. Po : 61 (RRIM)
. N2 : 0,42 (RRIM)
. P : 0,16 (RRIM)
. Mg : 0,1 (RRIM)
. scorch : 1,5 (RRIM)

- Rubber from cuplump

. Stabilized Mooney viscosity :
. Rate of cure :
. PRI : 91

- Centrifuged latex

. Mechanical Stability Time (MST) : very high, > 1200
. Volatile fatty acid content (VFA) :
. KOH number :

VI. RECOMMENDATIONS

In estates, PB 260 may be planted on large areas. It is recommended not to exceed 10 % of the total planted area due , first, to its recent introduction in Africa and Indonesia (1983-94 in North-Sumatra) and, second, to its susceptibility to TPD which is comparable to that of PB 235.

PB 260 should be tried in smallholder conditions with appropriate extension concerning exploitation system, in particular in zones suffring from *Colletotrichum*.

Clone file n 3 : RRIC 100

I. PRESENTATION

- Parents	:	RRIC 52 x PB 86
- Geographical origin	:	Sri Lanka (Rubber Research Institute of Ceylan) Introduced in Indonesia through the ANRPC 1974 international clones exchange.
- Recommendations	:	Sri Lanka class I Malaysia class II Indonesia class I (since 1992) Thailand class III Côte d'Ivoire classe IIa
- Available from	:	Southeast Asia and Africa.

II. MORPHOLOGICAL OBSERVATIONS

- Appearance in budwood garden: see description file in annex

- Trunk

Straight and vigourous.

- bark

Smooth with an average thickness. The bark is considered as poor with a low renewing in Indonesia. Average susceptibility to woundings.

- branch aspect

Some strong relay branches. The shape of the tree is stocky.

- Canopy

Flat. Good shading in the first years and remains well developed when growing old. The height is average. Defoliation is very early.

III. AGRONOMY

- Seed production time
Early.
- Grafting - bud emergence

Good grafting success.

- Immature growth (in cm, 1 metre high above ground level)

In Indonesia : North-Sumatra :

YEAR	2	3	4	5
RRIC 100	23,6	37,9	50,5	57,8
GT 1	21,5	33,1	45,7	51,6

Limah Puluh Estate, Socfindo, 1985

in RCI

YEAR	2	3	4	5
RRIC 100	17,3	26,2	37,8	48,0
GT 1	15,3	23,2	33,8	42,2

RRIC 100 has a very good growth before opening that occurs at 5 years old (before in North-Sumatra if using polybag budded stump).

- Growth after opening

Growth after opening is slow in RCI, with only 2,4 cm/year, considered as inferior to that of GT 1, but considered as average in Indonesia.

- Production

- At large scale in Indonesia (kg/ha/year) (source : IRRI, 1990)

Commercial block planting

YEAR	1	2	3	4	5
RRIC 100					
Kg/ha/year	710	1278	1645	1788	1907
Cumulated	710	1988	3633	5421	7328
GT1					
Kg/ha/year	742	879	1289	1494	1477
Cumulated	742	1621	2910	4404	5881

YEAR	6	7	8	9	10
RRIC 100					
Kg/ha/year	2134	2336	2616	2980	
Cumulated	9462	11798	14414	17394	
GT 1					
Kg/ha/year	1733	2053	2162	2163	1874
Cumulated	7614	9667	11829	13992	15866

RRIC 100 is a very high yielding clone with no production decrease during wintering. In term of level of production, it is one of the most yielding clones, with PB 260, RRIM 600 and RRIM 712 in North-Sumatra.

- ***At large scale in Indonesia : North-Sumatra*** : in kg/ha
1974 International clone exchange trial : Dolok Ulu estate :

YEAR	1	2	3	4	5
RRIC 100	1216	1634	2188	2273	3187
Cumulated	1216	2850	5038	7311	10498
GT 1	659	1040	1248	1277	1938
Cumulated	659	1699	2947	4224	6162

(Dolok Ulu Estate)
1974 International clone exchange trial.

YEAR	6	7	8	MEAN	% of GT 1
RRIC 100	2901	3074	2980	2432	141
Cumulated	13399	16473	19453		
GT 1	2472	2691	2440	1718	100
Cumulated	8634	11325	13765		

In North-Sumatra, RRIC 100's production is 41 % above that of GT 1.

2) In large scale in Côte d'Ivoire

YEAR	1	2	3	4	5	6	7
RRIC 100							
g/t/t	26,3	43,5	41,7	50,1	56,1	53,1	56,7
kg/ha/year	750	1640	1919	2324	2217	1998	2142
kg/ha cumulated		2390	4309	6633	8850	10848	12990
GT 1							
g/t/t	33,3	27,6	36,1	46,0	51,6	50,7	54,7
kg/ha/year	689	1154	1766	2309	2426	2153	2322
kg/ha cumulated		1843	3609	5918	8344	10497	12830

3) at large scale in Malaysia (kg/ha/year) Source: Planters' bulletin RRIM n 198 - 1989

YEAR	1	2	3	4	5	6	7	8	9
RRIC 100	910	1340	1630	1770	1930	2180	2090	1960	2160
GT 1	700	1180	1410	1640	1570	1960	2280	2340	2310

- Physiology

The physiological characteristics remain average but still need some additional knowledge. Average thiols rate is observed, probably limiting the potential of production of this clone.

- Exploitation system

Awaiting for more information on RRIC 100 's behaviour, it is recommended that an exploitation system similar to that of GT 1 be adopted.
In Indonesia, a good response to stimulation is observed.

IV. SECONDARY CHARACTERISTICS

- Wind damage susceptibility

RRIC 100 seems to be resistant to wind damage and does not suffer from strong storms either in Côte d'Ivoire nor in Southeast Asia (North-Sumatra).

- Tapping Panel Dryness susceptibility (TPD)

RRIC 100 is not susceptible to TPD.

- Leaf diseases susceptibility

RRIC 100 seems to be resistant to leaf diseases such as *Colletotrichum* and *Corynespora*, in Africa and in Asia. Defoliation is very early which is very favourable. Average resistency to Phytophtora and pink disease.

- Tapping panel

No particular susceptibility.

V. TECHNOLOGY

(from Sungei Putih if not mentionned)

DRC :> 41

- Rubber from latex

. Initial colour (latex)	: yellowish ; 3,7
. Final colour	:
. Ph	: 6,68
. Stabilized Mooney viscosity	: 82
. Rate of cure	: 9,5 (RRIM)
. Po	: 46
. N2	: 0,52 (RRIM)
. P	: 0,13
. Mg	: 0,019
. scorch	: 1,8 (RRIM)

RRIM experimentation shows that latex from RRIC 100 should not be used for centrifuged latex production (MST < 650)

- Rubber from cup-lump

. Stabilized Mooney viscosity	:
. Rate of cure	:
. PRI	: 90 and 87 for RRIM

- Centrifuged latex

. Mechanical Stability Time (MST)	: < 650
. Volatile fatty acid content (VFA)	:
. KOH number	:

VI. RECOMMENDATIONS

RRIC 100 is a promising clone. In RCI, its production potential is very similar but slightly above GT 1. In Indonesia, RRIC 100 has a definitly better level of production (superior of 41 % of that of GT 1). It is a very good clone for diversification due to its resistance to leaf diseases and its precocity.

Clone file n 4 : RRIM 600

I. PRESENTATION

- Parents : TJIR 1 x PB 86

- Geographical origin : Malaysia (Rubber Research Institute of Malaysia), appears in Indonesia in 1954.

- Recommendations : Malaysia class I
Indonesia class I (since 1974)
Côte d'Ivoire classe IIb
India class I
Planted at large scale in many Southeast Asian countries.

- Available from : Southeast Asia, Africa.

II. MORPHOLOGICAL OBSERVATIONS

- Appearance in budwood garden: see description file in annex

- Trunk

RRIM 600 has a medium growth in height in the first years. The cutting of the apex bud does not have any effect on growth nor on production, but the risk of increasing susceptibility to wind damage using this technique is controversial. When growing old, the tree may bend.

- bark

The bark has a medium thickness (5,9 mm) and tapping should be carefully done. Bark renewing is very good (4,5 mm). Susceptible to woundings.

- branch aspect

Branching is late and not homogeneous between trees. There is some big and small branches. Later, these big branches will lead to low and heavy branches.

- Canopy

Canopy is heavy. Shading is late but satisfying on condition that there is no clearing due to wind damage.

III. AGRONOMY

- Seed production time

Average to low. RRIM 600 seedlings have yellow leaves.

- Grafting - bud emergence

No particular problem.

- Immature growth (in cm, 1 metre high)

Growth in the first years is average. Opening may occur at the same time as GT 1, at 5,5 years old, but generaly, at 6 years old. This clone is rather heteronegeous.

in Indonesia, in cm :

MONTHS	19	24	31	36
RRIM 600	13,1	16,73	20,34	23,2
GT 1	14,21	18,02	21,71	26,97

Source : M Delabarre.

In West-Java, in cm :

	34 months	44 months	56 months	68 months	% of GT 1
RRIM 600	14,67	22,92	34,38	43,59	100,9

Cikumpay Estate, West-Java.

In North-Sumatra : average of 3 1974 clones exchange locations, in cm :

YEAR	1	2	3	4	5	6	7
RRIM 600	17,6	29	39,3	45,4	51,9	56,1	62,8

In RCI

YEAR	2	3	4	5
RRIM 600	15,1	23,0	33,3	39,7
GT 1	15,3	23,2	33,8	42,2

- Growth after opening

Average

- At large scale in commercial planting block in North-Sumatra :

Sei Rumbiya Estate : , London Sumatra Estates :

YEAR	1	2	3	4	5	6
RRIM 600 50 ha	1701	2556	2528	2999	2765	2756
Cumulated	1701	4257	6785	9784	12549	15305
GT 1 50 ha	2044	2727	2195	2335	2392	2834
Cumulated	2044	4771	6966	9298	11690	14524

YEAR	7	8	9	10	% / GT 1	
RRIM 600 50 ha	2708	2361	2260	2250		
Cumulated	18013	20374	22634	24884	105 %	
GT 1 50 ha	2225	2376	2170	2413		
Cumulated	16749	19125	21295	23708		

Planting in 1977, production from 1984 to 1993

RRIM 600 has a production 5 to 14 % above that of GT 1 in North-Sumatra.

- production

RRIM 600 is a high yielding clone , very popular by smallholders in Malaysia and Thailand. Its level of production is correct, 5 to 14 % above that of GT 1 in North-Sumatra estates conditions.

- At large scale in Indonesia (kg/ha/year) (source : IRRI, 1990)
At commercial planting in North-Sumatra.

YEAR	1	2	3	4	5
RRIM 600					
Kg/ha/year	751	1031	1392	1745	1881
Cumulated	751	1782	3174	4919	6800
GT1					
Kg/ha/year	742	979	1289	1494	1477
Cumulated	742	1721	3010	4504	5981

YEAR	6	7	8	9	10
RRIM 600					
Kg/ha/year	2020	2438	2226	2389	2302
Cumulated	88820	11258	13384	15870	18172
GT 1					
Kg/ha/year	1733	2053	2126	2163	1874
Cumulated	7714	9767	11893	14056	15930

- ***2) In large scale in Côte d'Ivoire***

YEAR	1	2	3	4	5	6
RRIM 600						
g/t/t	45,5 (7)	56,5 (6)	66,0	67,0	62,2	65,2
kg/ha/year	1088	1734	1957	2118	1978	1759
kg/ha cumulated		2822	4779	6897	8875	10634
GT 1						
g/t/t	30,1	38,6	46,5	52,2	51,0	56,1
kg/ha/year	813	1533	2065	2262	2171	2292
kg/ha cumulated		2346	4411	6673	8844	11136

year	7	8	9	10	11	12	13
RRIM 600							
g/t/t	66,4	54,8	77,1	54,3	54,3	49,9	40,6
kg/ha/year	1738	1897	2390	1969	1969	1926	1545
kg/ha cumulated	12372	14269	16659	18628	20597	22523	24068
GT 1							
g/t/t	49,3	55,8	65,9	57,5	57,5	59,4	47,4
kg/ha/year	2099	2059	3892	2253	2253	1997	1523
kg/ha cumulated	13235	15294	19186	21439	23692	25689	27212

In RCI, RRIM 600 is not superior to GT 1.

3) At a large scale in Malaysia (kg/ha/year) Source: Planters' bulletin RRIM n 198 - 1989

YEAR	1	2	3	4	5	6	7	8
RRIM 600	720	1210	1600	1860	2310	2320	2350	2470
GT 1	700	1180	1410	1640	1570	1950	2280	2340

YEAR	9	10	11	12	13	14	15	16
RRIM 600	2700	2360	2190	2040	2660	2940	3260	
GT 1	2310	1880	2040	1700	1530	1670	1640	

RRIM 600 is a high yielding clone. Its level of production is explained by a good production per tree compensating a relatively heterogenous and low number of tappable trees per ha (due to susceptibility to wind damage and to tapping panel diseases). Decrease of production during wintering is average. Production is constant from July to December in Côte d'Ivoire.

In Indonesia, a decrease in production appears at wintering.

- Physiology

The physiological characteristics are very average, despite average sucrose rate and dry extract rate.

- Exploitation system

RRIM 600 answers well to stimulation, comparable to GT 1. It is recommended to adopt d/4 6d/7 with moderate stimulation.

IV. SECONDARY CHARACTERISTICS

- Wind damage susceptibility

RRIM 600 is considered as resistant to wind damage in Malaysia. Canopy grafting have been experienced in Côte d'Ivoire without any clear effect indicating any positive effect on resistance to wind damage, but a negative effect on production up to a decrease of 20 to 30 % depending on clonal canopy grafting. All observations in Côte d'ivoire and Cameroon show a certain susceptibility, in particular in estates with plot clearings due to *Fomes*.

- Tapping Panel Dryness susceptibility (TPD)

RRIM 600 is rather susceptible to TPD, in particular in case of intensive tapping, that can lead to deforming brown bast.

- Leaf diseases susceptibility

Few susceptibility has been observed in Côte d'Ivoire. RRIM 600 seems to be sometimes susceptible to *Colletotrichum* In Cameroon. RRIM 600 could be susceptible to *Corynespora* although no observations have been recorded so far in Africa.

RRIM 600 is susceptible to *Fusicocum*.

- Tapping panel

Very susceptible to black stripes, requiring systematic treatments.
RRIM 600 is susceptible to woundings.

V. TECHNOLOGY

(From Sungei Putih if not specifically mentionned)
(mean between brackets)

DRC : 38-41 % (IRRI) and 34-38 % (RRIM)

- Rubber from latex

. Initial colour (latex)	: white : 3,2
. Final colour	: pale
. Stabilized Mooney viscosity	: low for IRRI 61-70 (65) and very low : 52-55 for RRIM
. rate of cure	: fast (mod 7; 8,8 for RRIM)
. pH	: 6,7
. pH of coagulation	: 4,48
. Po	: 39 IRRI and 42 RRI)
. N2	: 0,5 (RRIM)
. P	: 0,13 IRRI and 0,29 RRIM
. Mg	: 0,05 IRRI and 0,16 RRIM
. scorch	: 1,5 (RRIM)
. Wallace plasticity	: 36-43 (39)
. Ash content	: 0,28-0,46 (0,36)

- Rubber from cup-lump

. Stabilized Mooney viscosity	: low (50), RRIM
. Rate of cure	: average (mod 0,7), RRIM
. PRI	: average, without seasonal variations. 95 IRRI and 91 RRIM.

- Centrifuged latex

. Mechanical Stability Time (MST) : low (300 ms), without additives.
900-1200 RRIM

. Volatile fatty acid content (VFA) : 0,49
. KOH number

MST may be easily corrected.
Upward taping and tapping on young trees have very negative effects.

VI. RECOMMENDATIONS

Due to its moderate susceptibility to wind damage, RRIM 600 should be recommended with care in North-Sumatra. RRIM 600 may be planted in zones without doubts or any risk of wind damage (South-Sumatra, West-Kalimantan....). RRIM 600 has been widely adopted by smallholders in Malaysia and Thailand. It can be recommended for smallholders in South-Sumatra and Kalimantan.

Clone file n 5 : GT 1

Susceptible to Colletotrichum leaf disease

I. PRESENTATION

- Parents : primary clone

- Geographical origin : West-Java (Gondang Tapen), in 1921. In class I since 1940 in Indonesia.

- Recommendations :
  Malaysia : class I up to 1992
  Indonesia : class I
  Côte d'Ivoire : classe I
  India : class I

- Available from : One of the most planted clones in the world.

GT 1 is the most planted clone in Indonesia : 48 % of rubber estates area have been planted with GT 1 (1992), around 300 000 ha in Indonesia, and most smallholder project (NES and SRDP) adopted GT 1 for smallholder development until 1990. It has ben used as a control in many trials. Unfortunately, its susceptibility to *Colletotrichum* restricts its use in locations such as humid rubber growing areas, in particular in West-Kalimantan, but also Bengkulu, West-Sumatra and Jambi provinces in Sumatra.

II. MORPHOLOGICAL OBSERVATIONS

- Appearance in budwood garden: see description file in annex p 9-10

- Trunk

The trunk is straight and regular with some irregularities in the lower part, sometimes up to spin aspect. The grafting scar remains marked.

- bark

The virgin bark, as the regenerated bark, is average, quite soft, presenting no problems at tapping. In Indonesia, the renewing of the bark is poor. Virgin bark at opening : 5,6 mm, after tapping : 3,7 mm (Sungei Putih). GT 1 is relatively tolerant to woundings, in particular for smallholder conditions.

- branch aspect

The branching is often quite late and characterized by medium branches with a close angle. The secondary branches are light and low.

- Canopy

The canopy is high. Shading is late but efficient. Wintering defoliation is late and complete, but irregular in the first years.

III. AGRONOMY

- Seed production time

Seed production is abundant. Seeds are small and with a good germination rate. GT 1 seedlings are considered as very good rootstocks.

- Grafting - bud emergence

Correct. A rating of 5 to 10 % for replacements for a polybag planting should be considered.

- Immature growth (in cm, 1 metre high above ground level)

In North-Sumatra

YEAR	2	3	4	5	6	7
GT 1 (1) Sungei Putih		19,5	31,4	42,2	47	52,3
GT 1 Limah Puluh	21,5	33,1	45,7	51,6		
GT 1 (3) Limau Mungkur	16,4	28,6	40,5	49	53,9	

(1) Sungei Putih Research Station. Budded Stump.
(2) Limah Puluh estate (Socfindo). Polybag.
(3) KP 50 Experimental Garden Limau Mungkur. Polybag.

in RCI (Africa).

YEAR	2	3	4	5
GT1	15,3	23,2	33,8	42,2

Bimbresso Research Station.

Growth is average in Indonesia. Opening occurs at the age of 5,5 years in Sumatra and between 6 to 7 years old in West-Kalimantan due to poor soil conditions and strong leaf disease attacks (*Colletotrichum*) as well as pink disease. However, using planting with polybagged budded stump, immature period can be reduced to 5 years in the southern part of South-Sumatra Province and in estates in North-Sumatra.

- at large scale in North-Sumatra :

1974 International clones exchange trial in 3 locations :

Year	1	2	3	4	5	6	7	8	mean
Sungei Putih									
kg/ha	905	1185	1247	1654	1925	2052	2289		1609
Cumulated	905	2090	3337	4991	6916	8968	11257		
Paya Pinang									
kg/ha	625	812	1189	1571	1485	1288			1150
Cumulated	625	1437	2626	4197	5682	6970			
Dolok Ulu									
kg/ha	649	1040	1248	1277	1913	2472	2691	2440	1718
cumulated	649	1689	2937	4214	6127	8599	11290	13730	

- at large scale in North-Sumatra :

Sei Rumbia estate :

year	1	2	3	4	5	6	7	mean	
kg/ha	788	1371	1881	2466	2315	2442	2527	1970	
Cumulated	788	2159	4040	6506	8821	11263	13790		
in g/t/t	16,7	29,4	40,2	51,9	47,5	49,5	52,6	41,1	

- Growth after opening

Growth after opening is slow but very homogeneous.

- Production

- At large scale in Indonesia (source : IRRI, 1990)

Commercial block planting : in North-Sumatra

YEAR	1	2	3	4	5
Kg/ha/year	742	979	1289	1494	1477
Cumulated	742	1721	3010	4504	5981

YEAR	6	7	8	9	10
Kg/ha/year	1733	2053	2126	2163	1874
Cumulated	7714	9767	11893	14056	15930

- ***In Sembawa, South-Sumatra, at large scale*** (Source : Pontianak 1990 conference proceedings) : in g/t/t :

Year	1	2	3	4	5	6	7	8	9	10	Mean
GT 1	17,7	20,8	24	28;7	43,1	41,1	38,2	43,7	37,1	37,7	33,2

- ***At large scale in Côte d'Ivoire*** (source : Fichier Clone CIRAD-CP)

YEAR	1	2	3	4	5
GT 1					
g/t/t	30.1(13)	38.6(10)	46.5 (9)	52.2 (8)	51.0 (7)
kg/ha/year	813	1533	2065	2262	2171
kg/ha cumulated		2346	4411	6673	8844
YEAR	6	7	8	9	10
GT 1					
g/t/t	56.1	49.3 (4)	55.8 (3)	65.9 (9)	57.5 (1)
kg/ha/year	2292	2099	2059	3892	2253
kg/ha cumulated	11136	13235	15294	19186	21439

- ***At large scale in Malaysia (kg/ha/year)*** Source: Planters' bulletin RRIM n 198 - 1989

YEAR	1	2	3	4	5	6	7	8
GT 1	700	1180	1410	1640	1570	1960	2280	2340

YEAR	9	10	11	12	13	14	15	16
GT 1	2310	1880	2040	1700	1530	1670	1640	

This clone is high yielding. Production per tree is not that high but it is largely compensated by its homogeneity and its good secondary characteristics.
Wintering production decrease is considered as average in Africa but as good in Indonesia.
This clone has a better behaviour in Côte d'Ivoire (average production for 10 years around 2 tons/ha) than in Southeast Asia (1,7 tons/ha).

- Physiology

Physiological characteristics are favourable for a good production, except a moderate rate of phosphorus due to a medium metabolism activity.

- Exploitation system

See annex.
A medium rate of stimulation (4 to 6 per year) should be adopted and tapping panels after the first two years of exploitation should be alternated annualy.

A decrease in production is observed when tapping occurs close to the grafting point.

The shift from d/3 6d/7 to d/4 6d/7 shows a decrease in production of 7 %, and a decrease of 15 % to d/6 6d/7.

This clone is very productive with upward tapping.

In Indonesia, the response of GT 1 to stimulation is considered as low to average.

GT 1 stands daily tapping as commonly done by smallholders.

IV. SECONDARY CHARACTERISTICS

- Wind damage susceptibility

Average to good resistancy in Southeast Asia but not considered resistant in Côte d'Ivoire without consequences on production in estates.

- Tapping Panel Dryness susceptibility (TPD)

Average susceptibility to TPD with the classical system used in Côte d'Ivoire : d/4 6d/7 with 6 to 8 panel stimulations. Good resistency to TPD with 1/2 S, D/2 in Indonesia without stimulation.

- Leaf diseases susceptibility

Susceptible to *Phytophthora sp* in Southeast Asia, but with no importance in Côte d'Ivoire.
Very susceptible to *Colletotrichum* in particular in West-Kalimantan but not to *Corynespora*. In Côte d'Ivoire, some attacks with *Colletotrichum* have been reported without consequences on production. GT 1 is not recommended in rainy zones in Indonesia where there are heavy rains above 2500 mm/year during refoliation, in particular in West-Kalimantan. GT 1 has an average resistancy to Oidium. GT 1 is severely attacked by pink disease in West-Kalimantan.

GT 1 is very susceptible to *Microcyclus ulei*.

- Tapping panel

GT 1 is easily tappped and not susceptible to woundings. Black stripes are well controlled with appropriate treatments.

V. TECHNOLOGY

(from Sungei Putih if not mentionned)
(Mean between brackets)

DRC : 34-38

- Rubber from latex

. Initial colour (latex)	: white yellowish ; 4,5 (lovibond)
. Final colour	: average
. Stabilized Mooney viscosity	: 72
. Rate of cure	: fast (8,3)
. Po	: 45
. N2	: 0,56 (RRIM)
. P	: 0,12
. Mg	: 0,025
. scorch	: 1,5 (RRIM)
. PH	: 6,7
. pH of coagulation	: 4,36
. Ash content	: 0,3-0,47 (0,37)
. Wallace plasticity	: 41-55 (45)

- Rubber from cuplump

. Stabilized Mooney viscosity	: 69-75 (72), [average (60) in RCI]
. Rate of cure	: average (mod 0,7) in RCI
. PRI	: 91-97 (95)

- Centrifuged latex

. Mechanical Stability Time (MST)	: good : 650-900 in RCI
. Volatile fatty acid content (VFA)	: average in RCI, 0,46 IRRI.
. KOH number	: average in RCI

Tapping on young trees and upward tapping have negative effects on centrifuged latex.

VI. RECOMMENDATIONS

In large scale : in class I in Indonesia, except for zones suffering from *Colletotrichum* (West-Kalimantan, Bengkulu, West-Sumatra and Jambi provinces).
GT 1 is often the recommended clone for smallholders due to its rusticity and its good agronomic characteristics.

GT 1 is the clone most known to planters and researchers. Despite its ancient origin, it is one of the most planted clones in the world. GT 1 is not particularely not recommended in locations with strong leaf diseases, such as Central Africa and West-Kalimantan in Indonesia.

Clone file n 6 : BPM 24

Susceptible to Colletotrichum leaf disease

I. PRESENTATION

- Parents : GT 1 x AVROS 1734

- Geographical origin : North-Sumatra, Medan, Indonesia
From AVROS, (APS 724), released in 1957.

- Recommendations : Malaysia class II
Indonesia class I (since 1984)
Thailand class I
Côte d'Ivoire classe III

- Available from : Indonesia, Malaysia, Thailand, Côte d'Ivoire.
BPM 24 contributes to 1,2 % of the estates planted area in Indonesia.

II. MORPHOLOGICAL OBSERVATIONS

- Appearance in budwood garden: see description file in annex

- Trunk

- bark

The bark is good and easily tapped. BPM 24 may be considered for smallholders. The bark renewing is average and the resistance to woundings is moderate.

- branch aspect

PBM 24 is a tree of average height, which has an important branching with some main branches.

- Canopy
Conical shape. Good shading. The crown is average.

III. AGRONOMY

- Seed production time

Very good seed production as early as the 4th year.

- Grafting - bud emergence

- Immature growth (in cm, at 1 metre high above ground level)

In Indonesia : North-Sumatra :

YEAR	2	3	4	5
BPM 24	22,4	33,1	43,5	53,2
GT 1	21,5	33,1	45,7	51,6

Limah Puluh Estate, Socfindo, 1985

in RCI.

YEAR	2	3	4	5
BPM 24			41,6	48,2
GT 1			39,4	47,2

The growth of BPM 24 is average, very close to that of GT 1. Opening occurs at the age of 5,5 years.

- Growth after opening

Low.

- Production

- At large scale in Indonesia (kg/ha/year) (source : IRRI, 1990)

Commercial block planting : North-Sumatra

YEAR	1	2	3	4	5
BPM 24					
Kg/ha/year	1616	1483	1799	1753	1775
Cumulated	1616	3099	4898	6651	8426
GT1					
Kg/ha/year	742	879	1289	1494	1477
Cumulated	742	1621	2910	4404	5881

YEAR	6	7	8	9	10
BPM 24					
Kg/ha/year	1747	2174	2271	2192	
Cumulated	10173	12347	14618	16810	
GT 1					
Kg/ha/year	1733	2053	2162	2163	1874
Cumulated	7614	9667	11829	13992	15866

BPM 24 has a good production in the very first years, largely above GT 1 but a sharp declining in production is observed showing that this clone may not keep its promising level of production (after 5 years in South-Sumatra and very similar to GT 1 after 6 years in North Sumatra). The production during wintering is average.

- ***At large scale in Indonesia : North-Sumatra*** : in kg/ha
1974 International clone exchange trial : Dolok Ulu estate :

YEAR	1	2	3	4	5
BPM 24					
Cumulated					
GT 1	659	1040	1248	1277	1938
Cumulated	659	1699	2947	4224	6162

(Dolok Ulu Estate)
1974 International clone exchange trial.

YEAR	6	7	8	MEAN	% of GT 1
BPM 24	2840	2528	2192	1986	115
Cumulated	11170	13698	15890		
GT 1	2472	2691	2440	1718	100
Cumulated	8634	11325	13765		

- at large scale in North-Sumatra :

1974 International clones exchange trial in 3 locations :

Year	1	2	3	4	5	6	7	8	mean
Sungei Putih									
kg/ha	905	1185	1247	1654	1925	2052	2289		1609
Cumulated	905	2090	3337	4991	6916	8968	11257		
Paya Pinang									
kg/ha	625	812	1189	1571	1485	1288			1150
Cumulated	625	1437	2626	4197	5682	6970			
Dolok Ulu									
kg/ha	649	1040	1248	1277	1913	2472	2691	2440	1718
cumulated	649	1689	2937	4214	6127	8599	11290	13730	

- at large scale in North-Sumatra :

Sei Rumbia estate :

year	1	2	3	4	5	6	7	mean	
kg/ha	788	1371	1881	2466	2315	2442	2527	1970	
Cumulated	788	2159	4040	6506	8821	11263	13790		
in g/t/t	16,7	29,4	40,2	51,9	47,5	49,5	52,6	41,1	

- ***At large scale in Malaysia*** (kg/ha/year) Source: Planters' bulletin RRIM n 198 - 1989

YEAR	1	2	3	4	5	6	7	8
BPM 24	990	1250	1600	1460	1530	1600	1370	1350
GT 1	700	1180	1410	1640	1570	1960	2280	2340

A comparison of yields between several locations in 3 countries shows that BPM 24 is really far above GT 1 production in Thailand.

- Physiology

Not well known. In Indonesia, a low response to stimulation is observed.

- Exploitation system

1/2 S D/2 commonly in Indonesia.

SECONDARY CHARACTERISTICS

- Wind damage susceptibility

Average to low in Malaysia. This clone is considered as moderately resistant in Indonesia.

- Tapping Panel Dryness susceptibility (TPD)

Average in Malaysia. Without being resistant, BPM 24 does not suffer the susceptibility of clones such as PB 235 or PB 260.

- Leaf diseases susceptibility

BPM 24 is generally considered resistant to leaf diseases, except for *Colletotrichum* in Indonesia, where it is considered as susceptible (not to be cultivated in Kalimantan).

- Tapping panel

No problem with *Phytophtora sp.*

V. TECHNOLOGY

(From Sungei Putih if not mentionned)

DRC : 38-41

- Rubber from latex
  - . Initial colour (latex) : yellowish ; 4,4
  - . Final colour :
  - . Ph : 6,76
  - . Stabilized Mooney viscosity : average (63) in Indonesia.
  - . Rate of cure : 7,9 (RRIM)
  - . Po : 38 (IRRI) and 39 (RRIM)
  - . N2 : 0,48 (RRIM)
  - . P : 0,10
  - . Mg : 0,044
  - . scorch : 1,4 (RRIM)

- Rubber from cup-lump
  - . Stabilized Mooney viscosity :
  - . Rate of cure :
  - . PRI : 95

- Centrifuged latex
  - . Mechanical stability (MST) : 650-900 (RRIM)
  - . Volatile fatty acid content (VFA) : no clonal variation observed by RRIM
  - . Potassium index (KOH) : no clonal variation observed by RRIM

VI. RECOMMENDATIONS

BPM 24 is amongst the best clones of the ANRPC 1974 clones exchange and is considered very promising.
This clone is recommended in Indonesia by IRRI, except in zones suffering from *Colletotrichum*, such as West-Kalimantan province.
BPM 24 is used in on-farm-trials in South-Sumatra.

PUBLICATIONS DU PROGRAMME TROPIQUES HUMIDES 1998

PRÉSENTATION SUCCINCTE DU PROGRAMME

Les agricultures des zones tropicales humides évoluent rapidement car elles sont de plus en plus liées aux grands marchés internationaux du café, du cacao ou du riz, et participent à l'approvisionnement de centres urbains en forte croissance. Dans ces zones peu anthropisées jusqu'au siècle dernier, la colonisation s'opère par de larges fronts pionniers et la vitesse de progression est telle qu'elle entraîne des risques de dégradation écologique irréversible.

Le programme "Tropiques humides" étudie l'évolution actuelle de ces systèmes agraires, à base de cultures pérennes et de cultures vivrières. Il raisonne la mise au point d'innovations dans le cadre d'exploitations familiales aux productions diversifiées (pour l'autoconsommation, pour les marchés locaux ou internationaux). L'objectif est d'aider à équilibrer le système de revenus agricoles tout en préservant la capacité de production de la terre cultivée.

Pour cela, les chercheurs du programme adoptent une approche pluridisciplinaire associant sciences écologiques, agronomiques, sociales et économiques, mises en oeuvre au sein d'opérations de recherche-action menées avec les utilisateurs potentiels des innovations testées. Ils interviennent sur différents terrains en Amérique latine, en Afrique, en Asie et en milieu insulaire à travers deux démarches : des synthèses régionales sur les évolutions en cours et des dispositifs d'analyse et d'expérimentation d'innovations à l'échelle locale.

Contacts scientifiques: Alain LEPLAIDEUR : alain.leplaideur@cirad.fr
Alain DUCREUX : alain.ducreux.cirad.fr
Edouard Latrille : edouard.latrille.cirad.fr

LISTE DES PUBLICATIONS

Demande de documents : *Nadine Kelemen*
Programme Tropiques Humides
CIRAD/TERA
B.P. 5035
34032 MONTPELLIER Cedex 1

Tél. (33)(0)4 67 61 59 66
Fax : (33)(0)4 67 61 12 23
e-mail : nadine.kelemen@cirad.fr

N° 1 - F. LANNELONGUE, P. SENG, C. ROMAIN, **G. VALLEE**, A. MADI. Gestion agrobiologique et développement durable des systèmes de culture à **Mayotte**. Mars 1998, 15 p.

N° 2 - J.M. IZARD, O. SOUMILLE, P. SENG, **G. VALLEE** - La réhabilitation des padzas à **Mayotte**. Mars 1998, 12 p.

N° 3 - C. BARTHES, C. ROMAIN. Stratégies familiales, systèmes de culture et fertilité du milieu à **Mayotte**. Mars 1988, 14 p.

N° 4 - R. PASQUIS, J.F. TOURRAND, J.P. LESCURE. Premiers éléments pour l'identification d'un projet écorégional en Amazonie. Rapport de mission en **Amazonie Brésilienne** du 10 Novembre au 10 Décembre 1997. Mars 1998, 45 p.

N° 5 - A. DUCREUX, N. SIBELET. Séminaire de formation à la prospective "Pour démarrer en prospective" du 27 au 30 janvier 1998 - Centre de formation du **CNRS** à **Gif/Yvette**. Mars 1998, 41 p.

N° 6 - G. VALLEE, B. LEDUC, C. BARTHES, B. MOURIDI, O. CHADHOULI. Diagnostics des systèmes de production à **Mayotte** - Première synthèse. Décembre 1997, 28 p.

N° 7 - E. PENOT. L'amélioration des agroforêts a Hévéa en Indonésie. (Article par dans la revue Plantations, Recherche et Développement - Vol 5 - N° 2/98. Avril 98, 7 p.

N° 8 - R. PASQUIS, J.F. TOURRAND. Rapport de mision au Brésil - 12 mai - 5 juin 1998. Proposition de projet régional - Dynamiques spatiales et gestion des ressources en Amazonie. 34 p.

N° 9 - Recueil des publications des chercheurs du Programme Tropiques Humides. 208 p.

N° 10 - E. PENOT, AFS BUDIMAN. Environmental aspects of smallholder rubber agroforestry in Indonesia : Reconcile production and anvironment. Paper presented at the International Rubber Conference 1998, Paris, May 1998. 23 p.

N° 11 - R. PASQUIS. Rapport de la mission réalisée à Boa Vista (Etat du Roraima) du 27 au 30 mai 1998 - "Evaluation de l'impact des feux (Queimadas) et analyse intitutionnelle". 21 p.

N° 12 - E. PENOT, B. JOBBE-DUVAL. Rapport de mision en Colombie du 17 au 31 janvier 1998. Projet PLANTE. 89 p.

N° 13 - E. PENOT, G. WIBAWA, I. KOMARDIWAN. Rubber planting materiel availability and production in Jambi Province. Executive summary. (A cooperation between the World Bank and the Governement of Indonesia. June 1998. 188 p.

Résumé :

Ce rapport sur la disponibilité et la qualité du matériel végétal d'*hévéa brasiliensis* dans la province de Jambi (Sumatra, Indonésie), a été commandité par la Banque Mondiale dans le cadre du projet de Développement Régional de Jambi.
L'objectif de la mission est d'identifier l'état de la filière production de matériel végétal d'hévéa dans la province en identifiant les acteurs (projets de développement, Service de vulgarisation/DISBUN, Recherche, Pépiniéristes privés), les potentiallités, les contraintes, les coûts et prix et la qualité des produits.
Il apparait clairement qu'il y a un déficit important de production de matériel végétal devant une demande croissante tant des projets que des petits planteurs. La production actuelle est de qualité toute relative, avec beaucoup de problémes de non-conformité clonale. L'analyse coût/bénéfice montre que cette activité de spécialisation des pépiniéristes , soutenue par une forte demande peut etre trés rénumératrice a condition de suivre un protocole de qualité de production. L'analyse des revenus des petits planteurs montre que ce n'est souvent pas le capital la contrainte majeure à l'emploi de clones dans les plantations paysannes mais d'une part la faible disponibilité du matériel végétal et , d'autres part, le manque d'informations techniques détaillées sur les clones et les techniques de mise en oeuvre des systèmes culturaux à base de clones (en monoculture ou agroforesterie).

Mots-clés : Hévéa, Indonésie, Sumatra, matériel végétal, clones, pépiniéristes privés, conformité clonale.